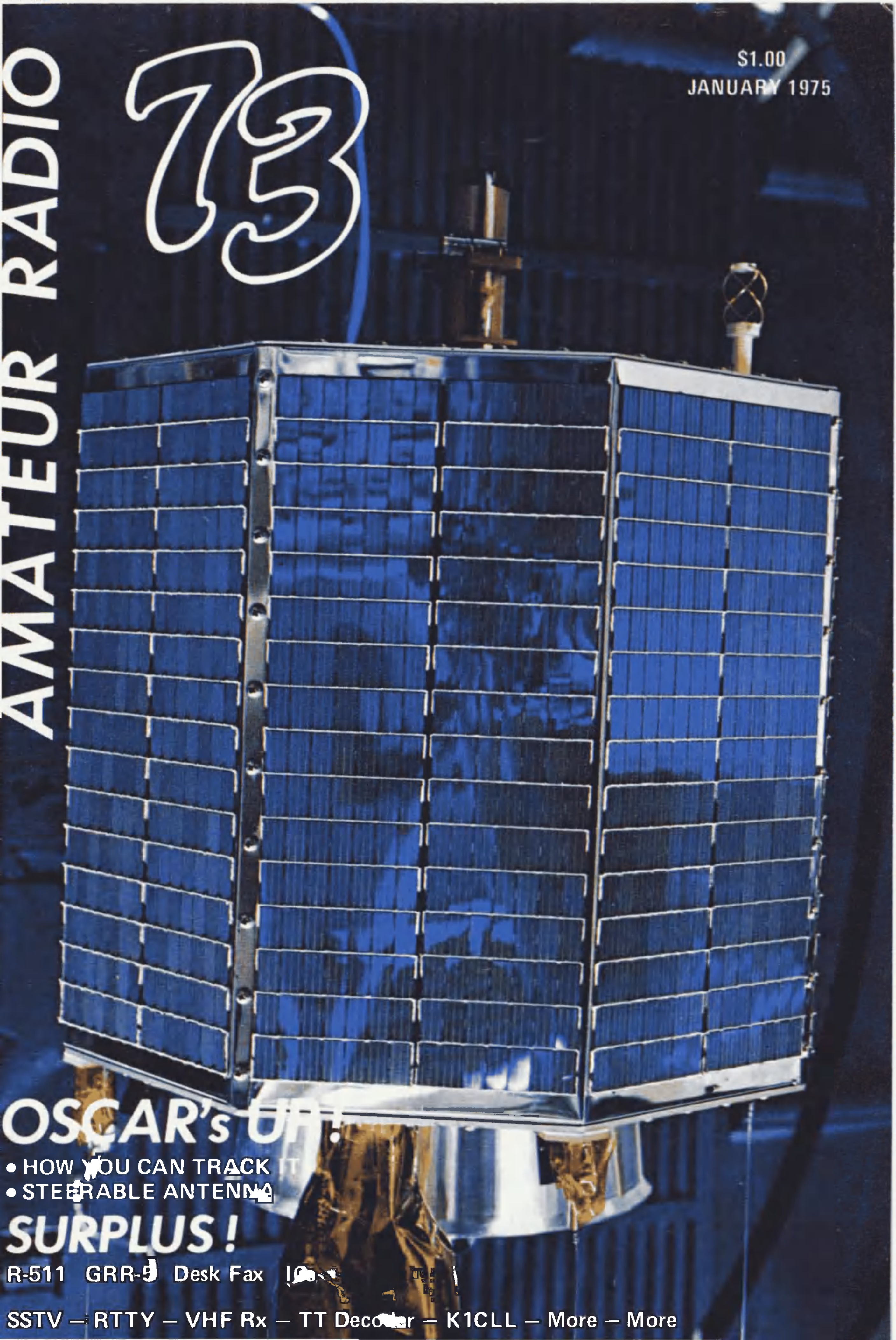

AMATEUR RADIO 73

$1.00
JANUARY 1975

OSCAR's UP!

- HOW YOU CAN TRACK IT
- STEERABLE ANTENNA

SURPLUS!

R-511 GRR-5 Desk Fax

SSTV — RTTY — VHF Rx — TT Decoder — K1CLL — More — More

#172 JANUARY 1975

73 AMATEUR RADIO

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*Cover photograph courtesy of NASA.
Submitted by Perry Klein.*

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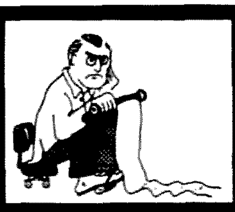


...de W2NSD/1

EDITORIAL BY WAYNE GREEN

ARRL BANDPLAN

The recently released ARRL Official Bandplan for the 450 MHz band has stirred up quite a controversy.

Critics of the "plan" say that it was put together with too little knowledge of the problems involved in allocating channels in that band. Some critics say flat out that politics were involved much more than common sense.

The ARRL plan calls for 450 repeaters to have their inputs on the high end of the band from 445-450 MHz. "Insane," say repeater operators in the major metropolitan areas. They point out that the signals and intermod from commercial repeaters just above the 450 band all fall within this segment of the band and putting the amateur repeater inputs there is just asking for troubles which are insolvable.

By putting the repeater inputs in the 440-445 MHz part of the band you get away from most of these interfering intermod products.

It is being pointed out that many repeater groups have tried the repeater outputs on the lower segment and have come to grief as a result.

Frequency coordinators also are alarmed over the ARRL proposal because it would put the 450 repeater inputs right on the second harmonics of the 224 MHz repeater output second harmonics. This alone, without considering the commercial repeater intermod problems, should be enough to scuttle the input-high scheme, they feel. Second harmonic output can be kept down, but there is no way to completely eliminate it. . .and this means coordinators will have to allocate 220 MHz repeaters so they won't interfere with 450 repeaters! Or should all of the 220 repeaters be inverted just so the ARRL 450 bandplan can be accepted?

Some standardization is needed since about half of the 450 MHz repeaters are low in and half are high in. It would seem that the League went off half-cocked on this one and more data should be gathered before a plan is pushed on repeater groups. Experienced repeater designers feel that any objective review of the evidence can only result in the East/West Coast plan being accepted instead of the Texas Plan – low in/high out.

HOTLINE MAIL

A good deal of the mail in recent weeks has been complimenting the job 73 has been doing with the bi-weekly Hotline report. To tell the truth the newsletter is fun for us at 73 to write and publish. The two month long deadline for 73 is so restrictive that little real news can be considered – it takes almost two months, when everything works smoothly, for something to get from a writer to the readers of 73 Magazine and that kills news of most DXpeditions and emergencies.

While the readership of the Hotline is a lot smaller than 73, numbering about 4000 subscribers plus nearly a thousand ham club bulletin editors, the eventual circulation of news is substantial since a great many of those editors reprint material from Hotline to help flesh out their club bulletins and make them a bit more up to the minute. Also, when you consider that the large part of the readership paid out $8 for a year of Hotline, so we know they are really active and enthusiastic hams. . .the kind it is enjoyable to write for.

In the mid-November issue we had news reports on a wide variety of items. There was the WB6JPI 15 kHz plan for permitting splinter repeaters to work with little or no interference to or from the 30 kHz repeaters adjacent to them – sheer genius, obviously. This was the scheme adopted by the first WR6 splinter channel repeaters authorized by the SCRA at the San Diego convention – all reported in this issue of Hotline.

Looking West editor Pasternak had a great story about PARC in L.A. finding a thief and getting him arrested when he turned up on the repeater. He had another about a tower law in L.A. being defeated by the hams. The moonbounce gang made it again, with details in Hotline. . .using a portable station, no less! DX news featured stories on the gang going to Navassa, the ZM7 operation, VP8MS on South Georgia, Trinidade and Chad. . .plus a good possible new country, Hutt River Province.

73's propagation expert has a special sunspot and DX report – the latest Walker news on the coming restructuring of the rules – petitions for RTTY code changes, for six meter

Continued on Page 117

Amateur Radio

MCMLXXV — Monthly Ham

OSCAR 7 IN ORBIT

After the usual series of delays they finally got everything working at once and booted Oscar 7 into orbit on November 15th. While you still can't pick up a hand transceiver and talk to someone over Oscar, the techniques of making contact via satellite are getting better known and a lot of amateurs are having a real ball using it. In addition to a series of articles in 73 on how to find and use Oscars 6 and 7, you'll find late info in the Amsat column in the newspages.

Licence Manual For Handicapped Planned

W1GVW/4 plans to publish a license manual for handicapped persons who are interested in becoming licensed amateurs. If you are a handicapped, deaf, or blind ham, or have worked with one, please send information concerning your experience, and pictures if you have them to: Ted Edwards W1GVW/4, Virginia Theological Seminary, Alexandria VA 22304.

KICLL BUSY IN THE PHILLIPINES

Bill Hoisington K1CLL, one of the ham fraternity's most original and prolific writers, is busy with a number of projects in Rizal, Philippines. His lovely wife, Pilar, who is trying to keep up with Bill's paperwork, writes that not only does Bill have some backers to produce some of his "brain children" but that he is connected with the engineering department of the State University and is writing regularly for one of its more esoteric publications. He is still inventing and building and hopes to find time to write up his latest creations. Pilar sent along some color photos of Bill and they do seem to show that he has managed a little time in the sun in spite of his heavy schedule.

Bill on the slope of the extinct volcano Mt. Makiling with a coconut grove behind him and a pile of jack fruit at his feet.

Bill and Pilar Hoisington.

F8EM

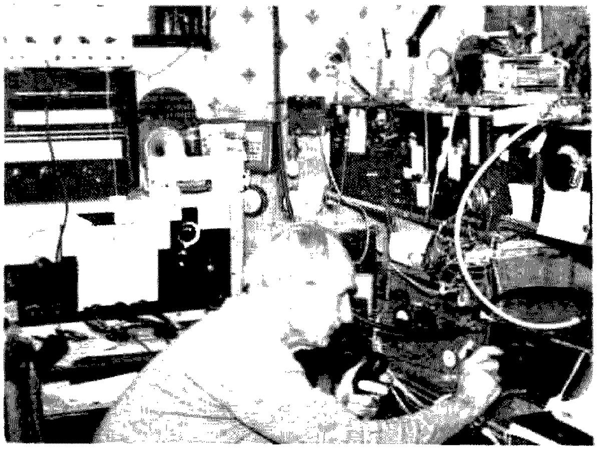
Well-known call on the DX bands is that of F8EM.

Near his QTH at COGNAC – where the best brandy comes from! – is a small river aptly named "l'antenne".

A former ship's "Sparks", Leo has been regularly on the bands since the twenties, and is a great believer in home-brew gear.

Photos by G3KPO

Leo by the marker of his river.



Leo F8EM in his shack-all home brew!

Bill Pasternak WA2HVK/6
Associate 73

They Took Their Repeater With Them!

Every two minutes while the machine was keyed on, the voice of Bella Romain WA2CZU could be heard over the city of San Diego proclaiming: "This is a special events repeater station WR6FM San Diego, sponsored by the Palisades Amateur Radio Club of Culver City". Bella was some 3,000 miles away, but her beautiful voice and natural speaking talent would be a part of P.A.R.C.'s participation in the Southwestern Division Convention held November 1, 2 and 3rd 1974 at San Diego's fantastic Town and Country Hotel.

Not only did the P.A.R.C. contingent arrive with their own repeater operating on 146.01-146.61, the same channel as their Hollywood Hills based home system WR6ABB, but not to be outdone by the many organizations that sponsored "Hospitality Rooms," P.A.R.C. showed up with a "Mobile Hospitality Motor Home" thanks to "Uncle" Earl Surad WB6MUQ. Located in the hotel parking lot near the entrance, it was the first stop for many enroute to the festivities. It also served as talk-in for anyone who might venture onto .01-.61 and found as many users as the convention's own .34-.94 system. With close to 2400 amateurs in attendance, many others beside the P.A.R.C. people found it of value.

Credit for the success of WR6FM must be given to two individuals well known in FM circles out here. Strapping together a MOCOM 30, a Motrac, some control circuits and my Norelco Carry Corder was the handiwork of Neil McKie WA6KLA. There are times when I think Neil knows more about Motorola radios and what they are capable of doing than the people that designed them. While WR6FM was nothing pretty to look at, it functioned faultlessly for the three days of the convention; a tribute to the expertise of WA6KLA. This is the same repeater that Neil had used earlier this year to provide communication for the Baja 500 auto race South of the Border. At least this time he had 110 Vac to run it off. Receive antenna was a Ringo atop a 20' pole outside the hotel room and transmitting was accomplished with a ¼ wave whip clipped to a cabinet in the room. Though the system was effectively at ground level, it could be accessed from about the time San Diego was line-of-sight from the freeway and some amateurs told me that it was useable from downtown San Diego. Not bad for a portable system.

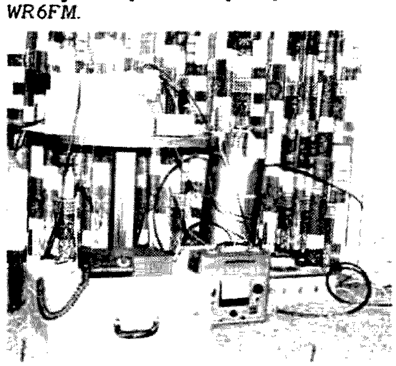
Ah, but I said that there were two people responsible for the success of WR6FM; someone had to apply for the license, do all the paperwork and hope it would be accepted by the FCC. That job fell on the shoulders of Fred Deeg K6AEH who is also licensee of WR6ABB. About six months ago Fred announced that he had applied for a special repeater call sign and permission to operate a portable repeater at the convention. It took a couple of months of nail biting but it finally came and P.A.R.C. was on it's way.

From all this you might get the idea that P.A.R.C. is a rather "together" active organization. You would be right. Lets face it, how many clubs take their repeater with them to an event such as this? P.A.R.C. does and S.A.R.O.C. is next. Hmmmmm, WR7FM?

Do P.A.R.C. people have more fun? Let the pictures speak for themselves.

Editor's note: payment for this article is being donated by the author to the PARC Repeater Fund.

Neil McKie WA6KLA and Fred Deeg holding the special temporary license for WR6FM.

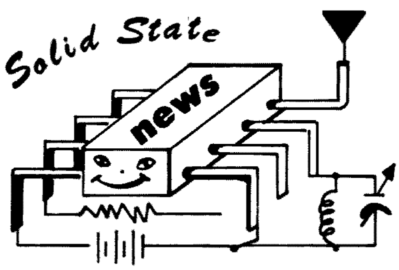


It may not look like much, but thanks to the genius of Neil WA6KLA it outperformed the .34-.94 talkin machine.

Some of the PARC contingent pose outside the PARC hospitality motor home provided by Earl WB6MUQ who is standing on the extreme left.

"Uncle Earl" WB6MUQ and Carl WA6JOW relax (party?) inside PARC hospital motor home between convention events.

Fred K6AEH, his wife Marsha WA6CUF and Larry K6YUI enjoy a last cup of coffee before the ride back to L.A.



Walter Scott K8DIZ
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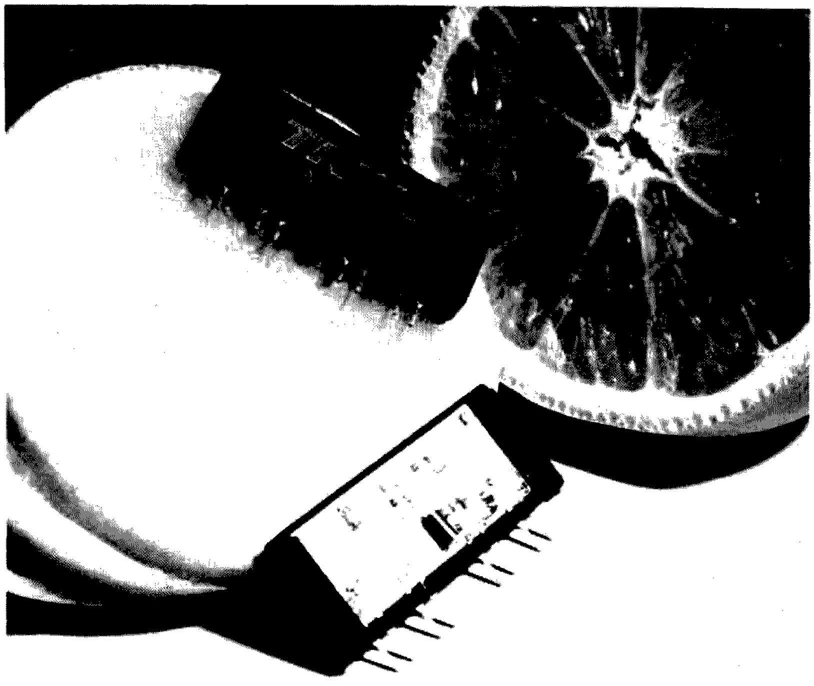


TRW MX1.5 broadband UHF power amp.

One of the most useful pieces of test equipment around the shack is the multimeter. In the last couple of years the expensive digital version of the multimeter has come down in price to where some hams can afford to invest in one and measure their voltages, currents, and resistances much more accurately than ever before. Those who would be interested in building their own digital multimeter, either for fun or financial necessity, will be pleased with the 3½ digit Analog to Digital Converter set of ICs recently introduced by Siliconix. This pair of ICs forms the heart of a 3½ digit multimeter when combined with a clock oscillator, 7-segment displays, display drivers, power supply, and a switch selected voltage divider to determine the range of measurement.

The Siliconix LD110/LD111 A/D converter set offers high performance and versatility with a minimum of external circuitry. The set consists of a monolithic P-channel MOS digital processor (LD110) and a monolithic bipolar-PMOS analog processor (LD111). The features of the A/D converter set include an accuracy of ± 0.05% of the reading 1 count; a 4 pico-amp typical input bias current; an input impedance of greater than 1,000 Megohms; autozeroing; and a single reference voltage requirement. External user-selected components allow selection of two different voltage ranges (2.000 V and 200.0 mV). This is the basic full scale range of the multimeter. The range selector switch and its voltage dividers allow up to 5 decades of voltage measurement (200 mV to 2000 V). Also, a wide range of sampling rates can be selected (1/3 to 12 samples per second) to accomodate a variety of applications. Fig. 1 shows the functional block diagram of the LD110/111.

The monolithic LD111 analog processor contains a bipolar comparator, a bipolar integrating amplifier, two MOSFET input unity gain amplifiers, several P-channel analog switches and the necessary level shifting drivers to allow the analog and digital processors to be directly interfaced. All amplifiers are internally compensated.

The PMOS LD110 synchronous digital processor combines the counting storage, and data multiplexing functions with the random logic necessary to control the quantitized charge-balancing function of the analog processor. Seventeen static latches store the 3½ digits of BCD

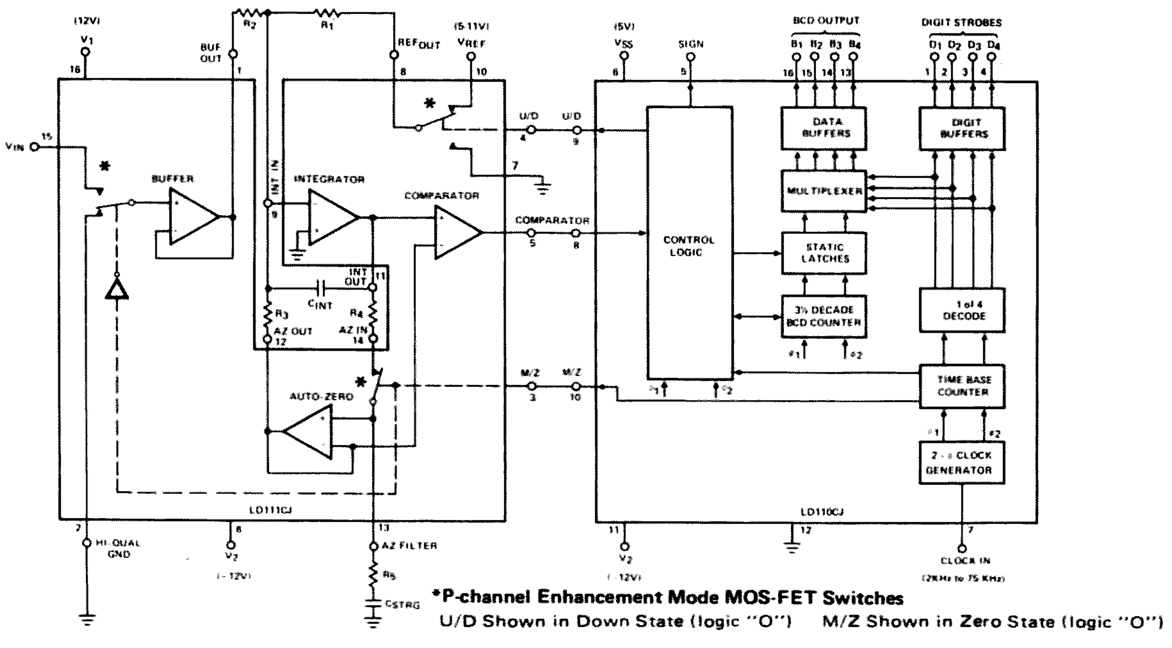


Fig. 1. Functional block diagram of LD110/LD111.

data as well as overrange, underrange, and polarity information. Nine push-pull output buffers (capable of driving one TTL load each) provide the sign, digit strobe, and multiplexed BCD data outputs. These outputs are all active high. The digits are scanned in an interlace format: 1,3,2,4.

The conversion technique is a form of dual slope integration. This method balances the charge supplied by a current proportional to the input voltage, over a measured time interval, with an accumulation of quantitized charges whose number equals the BCD count. The units of quantitized charge are provided through pulse width modulation of a reference current.

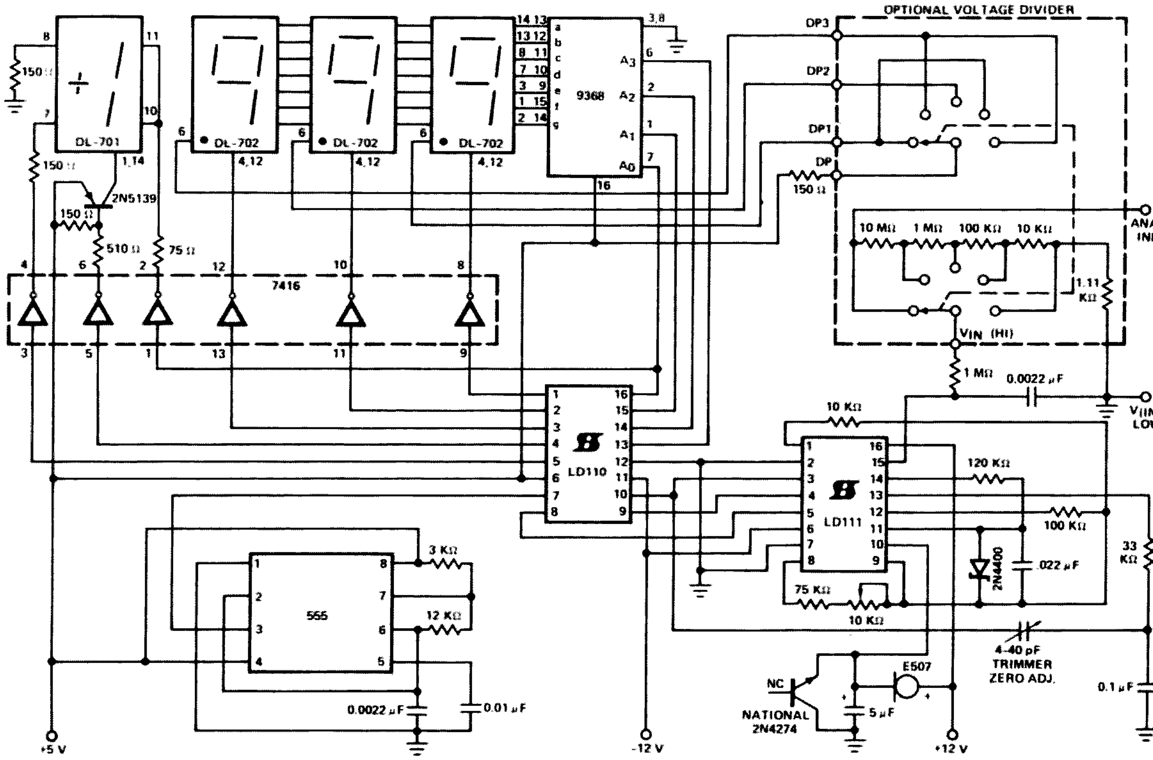


Fig. 2. Digital voltmeter using LD110/LD111.

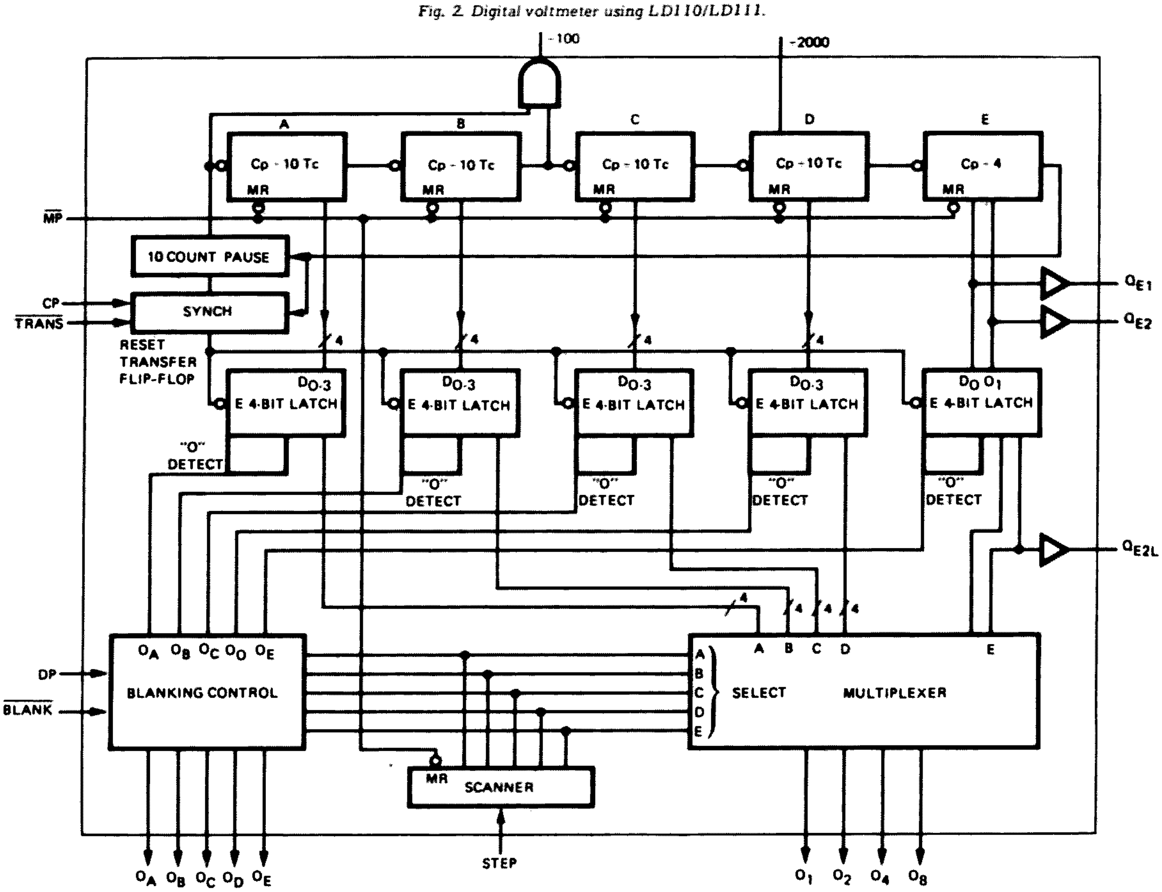


Fig. 3. 3814DC DVM logic array.

Fig. 2 shows a schematic of a DVM using the LD110/111. With the addition of some current shunts and a current source the DVM could become a DMM.

The 3½ digit A/D set of ICs is available from Siliconix for $40.85 in single quantities (LD110CJ – $18.35, LD111CJ – $22.50). An application note (AN74-1) and a design aid (DA74-1) are available to aid in the proper design of a DMM using these circuits. A complete PC layout and parts list is included.

Fairchild Semiconductor has developed a silicon gate device that contains most of the logic required for a 4½ digit DVM. All necessary BCD counters, latches, and the display multiplexing logic is on the chip. In addition, the control signals necessary for dual slope integration are generated by the 3814DC device. The BCD outputs can directly drive a BCD to 7-segment decoder. Zero suppression is generated on chip by feeding back the digit select output. Outputs are also provided for indicating overrange and underrange. A unique feature of the 3814DC is the incorporation of a 10-count pause at the start of an integration cycle to mask noise generated when switching the external analog circuits, such as the reference current source.

A reliable and accurate DVM circuit must be insensitive to long term changes of supply voltage, time base, and passive and active component values. It must be able to reject 60 Hz line noise. Dual slope integration achieves a high degree of accuracy by causing the effect of changes in these parameters to cancel.

One method of dual slope integration involves integrating a current directly related to the unknown voltage for a fixed period of time, followed by the integration of a standard reference current until the integrator output returns to zero. The amount of time required to null the integrator is directly proportional to the ratio of unknown to reference current and therefore, to the unknown voltage. Since the same system power supply, time base, and components are used for integrating the known and unknown currents, their absolute values are not extremely critical. Fig. 3 shows the block diagram of the 3814DC DVM logic array.

The 3814 is just the major portion of the voltmeter logic. The analog portion of the circuit is constructed using separate linear IC's. Fig. 4 shows a DVM circuit using the 3814. Range selection circuitry and power supplies are required in addition to the components shown. The DVM can be built with a total of 7 IC.s. Cost in single quantities is $16.50 for the 3814DC.

A new line of rf power modules from TRW Semiconductors is designed specifically for UHF handheld transceivers. The MX1.5 device operates from a 7.5 V battery in the 400-512 MHz range. Rated output is 1.5 W. (See table 1).

These broadband power amplifiers have 50 Ohm input and output impedances and are stable under all operating conditions of voltage and drive, and provide excellent harmonic suppression. A series of 4 modules is available for UHF and a 25 W module for the 2m band has just been introduced. The 7.5 to 25 W devices are packaged in a case similar to the MX1.5 except a flange is added to the

TABLE 1

TYPE	FREQ. (MHz)	POWER OUT (W)	POWER IN (mW)	VOLTAGE (V)	% EFFICIENCY	SINGLE QTY PRICE
MX1.5	400-512	1.5	35	7.5	45	$41.75
MX7.5	400-512	7.5	125	12.6	33	$46.00
MX12	400-512	12.0	150	12.6	35	$52.00
MX15	400-470	15.0	200	12.6	35	$56.00
MV25	135-180	25.0	200	12.6	35	

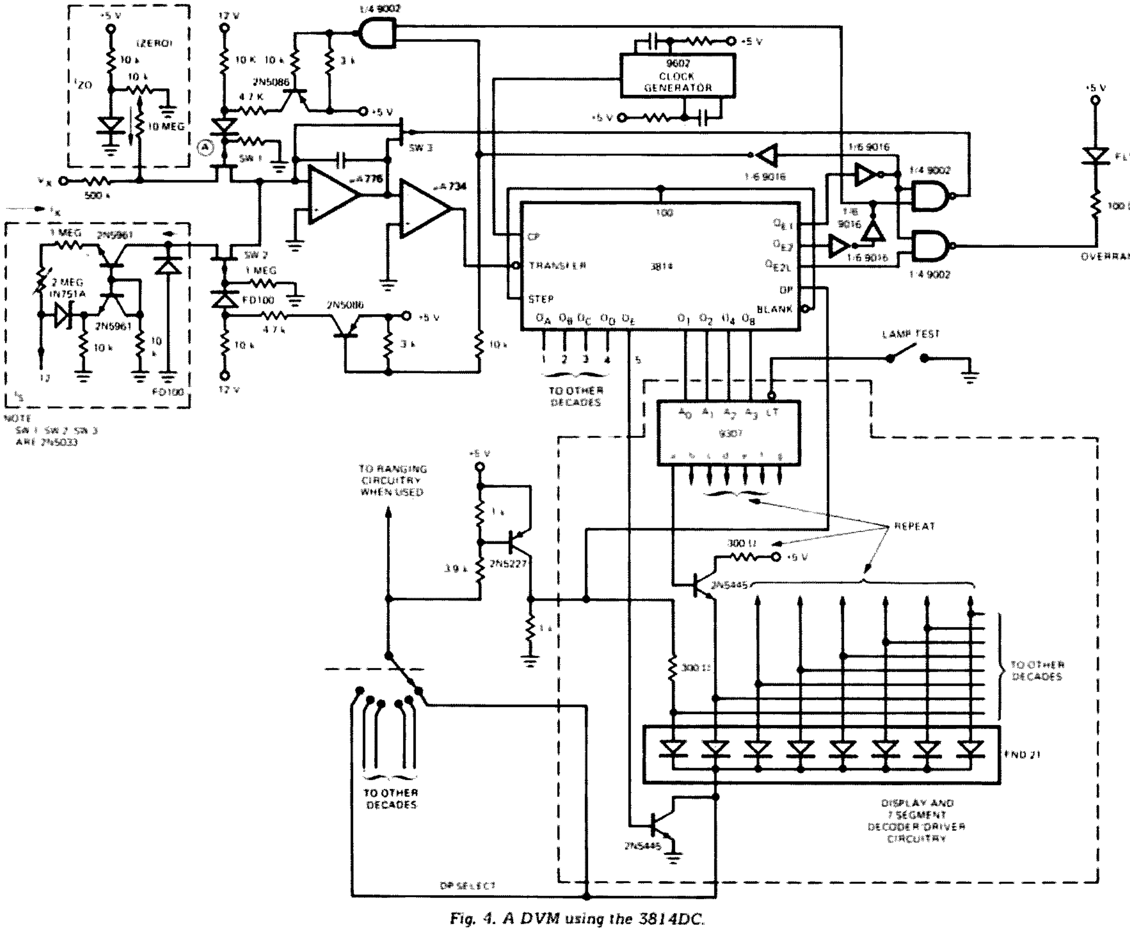
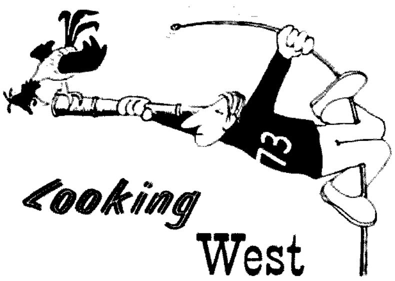


Fig. 4. A DVM using the 3814DC.

back of the case to allow bolt on mounting to a heat sink.

Harmonic suppression in excess of 30 dB and the capability to withstand infinite SWR are common to all modules. Use of these modules in a small FM rig would have several advantages over a discrete amplifier. Among them would be improved reliability, small size for the amount of gain avilable, and a much faster design process. Further info is available from TRW RF Semiconductors, 14520 Aviation Blvd., Lawndale, California 90260.

73 for now!



Bill Pasternak WA2HVK/6
14725 Titus St. #4
Panorama City CA 91402

Suppose you are an area coordinating group faced with a growing list of requests for co-ordinated channel pairs on 2 meters from those wanting to put their systems into operation. You have a major problem since all available 30 kHz allocations between 146 MHz to 148 MHz are assigned and operating as well as having a number of simplex channels co-ordinated to active repeaters. Your list keeps growing but you have no place to put the newcomers. You realize that you must act soon if you don't want those waiting to go ahead on their own and "jump" an already assigned channel pair. You have but one alternative; open up and assign to those waiting the split-split 15 kHz separation channels.

On November 2, 1974, at their meeting in San Diego, this was but one of the pressing problems that faced the Southern California Repeater Association. They had to find and clear at least two 30 kHz channel pairs for amateurs in Mexico to use for wide coverage systems. They were being petitioned for recognition and voting privileges by user groups. There was that Deviation Standard to establish for 220 MHz now that the many assigned allocations were coming to life. And much more right in the middle of an amateur convention that had turned record attendance. How would you have liked to be chairperson for this one?

The problem of more repeaters than channels available has been a growing one for the past few months. Keep in mind that when SCRA started two years ago, they had more than enough repeaters to fill every channel between 146 MHz to 148 MHz and a couple of machines to spare. For example, WR6ABE, the most active repeater in Los Angeles with 500 plus member users in the Mount Wilson Repeater Association, operates on a non-standard allocation of 147.435 in — 146.40 out. (This due to technical problems caused by its location atop Mt. Wilson.) Two years ago most of us thought that the growth of two meter FM would peak by now and the present number of systems would suffice. Were we ever wrong. At the moment there is no one who will even venture a guess as to when the peak will be reached. Daily there are a number of new users on most of the systems I operate. The need for more repeaters in Southern California is a real one and providing space for them is of top priority. Faced with this, the SCRA voted to open the tertiary 15 kHz split-split channels for immediate occupancy.

However, unlike the Northeast some years ago, the SCRA has no intention of letting things get out of their control. A set of specific parameters will be followed in these allocations. First, before even approaching the SCRA for sanction and assignment, those proposing the new system must first obtain the consent of the repeaters operating 15 kHz above and below the channel pair they intend to occupy. Second, split-split channels will be assigned only in areas geographically suited to the particular system and the terrain will be used as shielding between areas. Put more simply, .205 — 805 for example will be assigned as many miles from .17 — .79 and .22 — .82 as possible with as many mountains between sites as possible. Third, all split-split assignments will be temporary and existing 30 kHz systems will be given the right to challenge the new tertiary system should interference between systems occur. The SCRA intends to keep a close eye on the operation of the split-split's and intends to do everything within their power to minimize any co-channel problems that the new assignments may cause.

Actually, to the other systems the problems occuring may well be minimal with respect to the many FM users in the Southland. If any problem occurs it will probably be to the user with the amateur type transceiver with its rather broad receiver. At the same time I had WA2ZWP New York on .205-.805 I owned an IC-2F, TR-22, HR-2 and an RCA CMCT-60 as various mobile and fixed stations. Without installation of super-narrow filters in the receivers and further

Dick Flanagan W6OLD, SCRA chairperson leading a big meeting.

Many people besides the 46 repeater owners showed interest in this SCRA meeting.

. . .and they continued way into the evening.

modification to the audio and squelch circuits for proper operation with the reduced receiver bandwith the IC-2F, TR-22 and HR-2 were all but useless on the system. The deviation peaks of both .19-.79 and .22-.82 played havoc with the three aforementioned radios even in the prime coverage area of ZWP. Aside from converted commercial Motorola, G.E. and RCA radios, the only thing that worked well out of the box was the Sonar 3601 with a receiver in it that was way ahead of anything else in its day in the selectivity department. (Some of the new equipment around today still does not come factory equipped as selectively sharp as the 3601, but one must remember that the 3601 was built right in the area where ZWP and other tertiary split machines were coming to pass. In fact, their factory was but three miles airline from our site, but whether that had anything to do with the receiver design I would not venture to say.) The majority of our users eventually replaced the wide filters with much narrower counterparts and solved the problem, but that created still another problem. Many of the radios had no frequency netting capacitors on the receive crystals and with the ultra narrow filters many crystals that were thought accurate were found to be a couple kHz high or low with no way to adjust them back on channel. It was either modify the equipment further to install netting capacitors or purchase High Accuracy — High Stability crystals and pay the price. For a while I felt I was supporting International single-handedly.

The synthesized Icom 230 radios face still another problem. They are

designed around a 30 kHz separation – 600 kHz split and operate that or simplex, that's it. Many of the 230's in and around L.A. have been modified for crystal control on the non-standard ABE system, but the proliferation of tertiarys, should this occur, will necessitate major modification to the synthesized frequency determining element of the transceiver. These are beautiful radios, but their purpose will be defeated if every-time a split-split channel is to be used a set of crystals has to be plugged in.

Will today's more selective receivers be adequate? Will all not only those wishing to use a split-split repeater, modify their radios? Remember that a split-split is only that in relation to the repeaters either side and it can cause the user receive problems on existing channels; your receiver's selectivity curve is the same on either channel. Even if you don't operate the split-split you may still need the new filter installed. Finally, how many of these systems will eventually come on the air and will this add to the overcrowding? To the latter I say yes, at least for the foreseeable future. As to the rest, only time will tell.

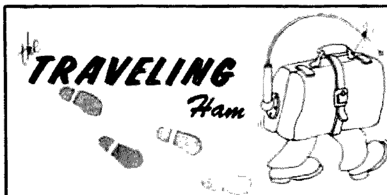
While on the topic of split-split systems, one of the most forward looking proposals to date has been brought forth by the Mt. Wilson Repeater Association. As proposed by Bob Thornberg WB6JPI, its President, and Russ Soloman WA6DUC, the official spokesperson for MWRA, it would invert the split-split allocations; ie: high in – low out between 146 to 147 MHz and low in – high out between 147 to 148 MHz. Eventually, after all allocations were filled, you would wind up with alternate repeater inputs and outputs every 15 kHz. Here is the logic to the idea. It is far easier to keep one signal on a given channel from interfering with its neighbors 15 kHz either side than it is to keep a couple hundred mobiles on channel and deviating properly. A 10 W mobile near a repeater output frequency will cause a lot less havoc than two repeaters will to each other. Also it is then only the individual repeater that will have to "filter" for an ultra-selective receiver since most of the time the users receiver will be seeing a 30 kHz slot. There might be some problem if two mobiles are operating on adjacent channels within close proximity of one another, but that shouldn't happen too often. Couple this with proper geographic spacing and use of terrain for shielding and it could make for a viable split-split system. At least it's worth both consideration and experimentation. In fact, one of the new split-split systems has announced its intention to try just that. The SCRA had adopted the "standard ARRL plan" that does not invert the splits.

This proposal submitted to the SCRA Technical Committee for evaluation is based on solid evidence of its viability. The input to the WR6ABE repeater is 147.435, technically a split-split channel. About a year ago, another machine, WR6AAB came on the air with its 147.500 output. Initially, some interference did exist, but Burt Weiner K6OQK, owner of WR6ABE, and Dave Corsiglia WA6TWF, owner of WR6AAB, were able to solve the problem in short order and without effecting the users of the two systems. It was solved by working with two people and two repeaters, not a couple hundred mobiles. Even though the two repeaters were on respective mountains line-of-sight to one another, there was but one transmitter and one receiver to contend with.

Now, while this proposal does not solve the split-split problem for the IC 230 owner, and in fact somewhat complicates it for him, it has the potential to solve it for the rest of us. If you are interested in receiving a two page copy of this proposal, or wish to comment on it, you can send a SASE to the Mt. Wilson Repeater Association, P.O. Box 10193, Glendale, California 91209. I too am interested in your comments.

A lot more transpired at this SCRA meeting, but to the rest of the country, the decision to activate the tertiary channels holds the most significance. Next month we will continue with this report and if any of the split-split's get on the air by that time we will let you know how things are going.

de WA2HVK/6



Joe Kasser G3ZCZ
1701 East West Highway, Apt. 205
Silver Spring MD 20910

In this month's column I'd like to pass on some details about operations in Japan, as presented by JA8MWO. There is no reciprocal operating agreement between Japan and other countries. That means that foreigners can not get operator licences. However they can get permits to operate club stations. If you are going to Japan the people to contact are the Tokyo International Amateur Radio Association (TIARA) at 22-5 Oyama-Cho, Shibuya-Ku, Tokyo 151. If you are already in Japan, call 466-6003 in Tokyo.

The frequencies available for use in Japan are different to those in use in the USA. On top band they can only use 1907.5 to 1912.5 kHz CW, on 80m they are allowed 3.5 to 3.525 kHz CW and 3.525 to 3.575 kHz phone. On 40m they have 7.0 to 7.03 kHz CW and 7.03 to 7.1 kHz phone.

On two meters FM is very big on simplex, repeaters not being legal. The main frequencies in use being 144.48 for calling and 144.36 for inter-island DX chasing. Their FM channels have 40 kHz spacing.

Yaesu is advertising a new rig in Japan and in Europe. It is called the FT-220 and is a two meter rig not a 220 rig. It covers 2 MHz of the band with SSB and CW. It even has 600 kHz spacing for repeater use. It costs about $400 and seems to be ideal for both local working and OSCAR use. When are they going to import it to the USA?

Turning from Japan to Europe, I'd like to update your list of two meter repeaters. Each of the ten channels is coded as follows:

CH. NR	INPUT	OUTPUT
R0	145.000	145.600
R1	145.025	145.625
R2	145.050	145.650
R3	145.075	145.675
R4	145.100	145.700
R5	145.125	145.725
R6	145.150	145.750
R7	145.175	145.775
R8	145.200	145.800
R9	145.225	145.825

The repeaters are located as follows:

ENGLAND

Cambridge	R6
London	R7

ISRAEL

Jerusalem	R7

SWEDEN

Bollnas	R2	Boras	R8
Gallivare	R2	Goteborg	R2
Huskvarna	R6	Kalmar	R8
Kiruna	R8	Malmo	R7
Nassjo	R2	Skelleftea	R4
Stockholm-2	R5	Stockholm-3	R8
Umea	R8	Uppsala	R6
Falun	R8	Helsingborg	R2
Karlskrona	R6	Mellerud	R4
Stockholm-1	R2	Sundsvall	R8
Ystad	R8		

DENMARK

Aalborg	R2	Bornholm	R2
Kobenhavn	R6	Lysnet	R6
Esbjerg	R2	Ringsted	R2

Do you know that on the 18th of August 1973 all amateur radio activity in the country of Afghanistan was ended by their government. That means that YA calls are no longer

heard on the air. Little seems to have been published about this happening in the amateur radio press, and with a frequency allocations conference coming up in the near future, one would think that someone would have raised a shout or two. Singapore lost the two meter band, France has put military stations in the two meter band, boy we are loosing our VHF frequencies slowly while the ham world looks forward to gaining new HF frequencies. Is that our future, only HF operations and no VHF activity? This possible future makes our use of VHF and UHF imperative at the present time, particularly with the OSCAR spacecraft. By the time that this appears in print there should be two amateur built spacecraft in orbit, both useable as communication relays.

Does anybody have any QSL bureau lables that they don't want? These are the labels that are affixed to QSL cards when they pass through the outgoing bureaux overseas. I'm putting together an exhibit of amateur radio in postage stamps and labels and could use some more labels. Talking of philately, first day covers of the launch of AMSAT-OSCAR 7 are still available from Amsat, Box 27, Washington DC 20044 for $1 and an SASE (business size #10).

...G3ZCZ

novice

Schley Cox WN9LHO
219 Kilgore Avenue
Muncie IN 47305

Contest operating is a lot like the "good for what ails you" snake oil elixir once sold by the traveling medicine show hucksters. . .it may not hurt you and it even may do you some good.

Any contest involving some CW activity – and that's most of them – will have some activity on the low end of the Novice bands. There are also some contests designed for Novice operators, taking place only in the Novice bands.

You say you're not interested in contests? Well, they may not hurt you. Working a contest improves operating skill. The extremely abbreviated contest message exchange could give a rag chewer the idea to get out that list of CW abbreviations and see if the length of his transmissions could be cut without cutting the content.

The fast break-in type exchanges might promote a more conversational like exchange on the CW bands instead of the rather stilted, rigid exchanges we now suffer.

Want to add some to your code speed? During contests I'm always amazed that the weights on my bug seem to get pushed up to the machine gun chatter position, and even more amazed that the ops on the other end seem to copy it solid with very few repeats.

Here are a few general contest operating hints. First, be modest. If you do your best and should happen to win something in the contest, shuffle your feet, smile a little, and say, "Aw shucks."

After you get your attitude in shape, make sure your equipment is ready. The antenna work should be done in the warm months. Roofs and poles are bad enough without a covering of ice. A lot of contest operators spend part of their summers carefully tuning the new antenna knowing that the big test won't come until the ice storms do. But your antenna should be designed so that you can get to the connections (or get them to you) and check them in nearly any kind of weather. Check ropes, pulleys and guys too.

The time to find a cold solder joint in the rig is before the contest, not during. Inspect your rig for loose connections and tubes and plug-in devices. Treat yourself to a few spare tubes if you can afford them. Saturday night is not the time to try and find a 6146B amplifier tube.

If you don't have earphones, get some good ones before the contest. Many of the conventional navy-type phones, even with rubber pads, get very uncomfortable after 24 hours of operating. Consider the stereo listener's type if you can match the impedance between the phones and your receiver.

If you have a TVI problem then quiet hours won't help you much during a contest. You need to take advantage of 15m whether there's a big Saturday game on or not. Consider the use of a tuner, a TVI filter, or better shielding to keep peace in the world.

Get some rest before the contest. You'll need it. Many of them run for 24 hours out of a possible 30. That leaves a little time for a nap, church and a few pit stops. Cajole somebody into bringing you food in your shack during the contest. Promise to take the trash out for a week.

The major contests are listed in advance in the radio magazines. Check and see if there is any Novice activity planned, send for the log sheets and any special operating aids that might go with the contest. Remember to read the current rules very carefully. Contest rules change from year to year so don't look them up in an old back issue. Follow the rules to the letter.

Keep a copy of the contest log with your regular log. Most contests generate some QSL activity. During a recent contest I worked 48 states, including KH6, KL7, Delaware and Wyoming.

Like the man said, "It may even do you some good."

QSL CONTEST

Arnold Goldman, our winner this month, has used a photo of his lovely YL assistant op "chewing the rug". Arnold wins a free year's subscription to 73. Keep sending your cards. You could be a winner. Mail to 73, QSL Contest, Peterborough, NH 03458.

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

OSCAR 7 UP

Once OSCAR 7 is in orbit and the onboard batteries have had time to charge (about two days), the operating schedule below is expected to be the one OSCAR 7 will use.

Sun., Tues., Fri. . . .two-ten meter repeater on: uplink – 145.85-145.95; downlink – 29.4-29.5; beacon – 29.5.

Mon., Thurs., Sat. . . .432-145 MHz repeater on: uplink – 432.125-432.175; downlink – 145.925-145.975; beacon – 145.98.

Wed. . . .Recharge mode, special use by arrangement only.

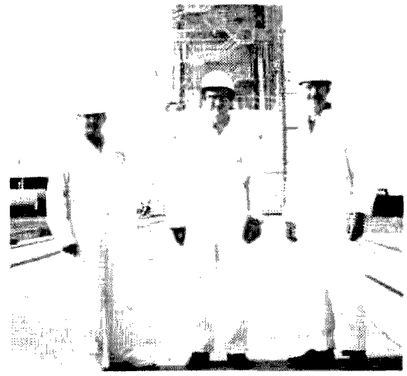
OSCAR 7 FIRST DAY COVER

Amsat has made arrangements for 2000 first day covers to be made available for amateurs interested in stamp collecting – and these should turn out to be real collector's items. The first thousand will have the hideous purple amateur radio stamp on them, the second thousand will use the Progress in Electronics stamp. Send S1 or five IRC's for the cover, plus a SASE #10 envelope for return. . .or one extra IRC if no postage for the return. Send to Amsat, Box 27, Washington DC 20002.

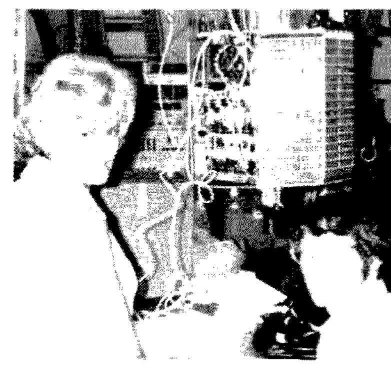
JOIN AMSAT

The Radio Amateur Satellite Corporation (AMSAT) is a non-profit, tax-exempt organization founded in the greater Washington, D.C. area five years ago. It is a membership organization open to all radio amateurs and interested non-amateurs. AMSAT's satellite programs are supported entirely from donations, membership dues, and grants.

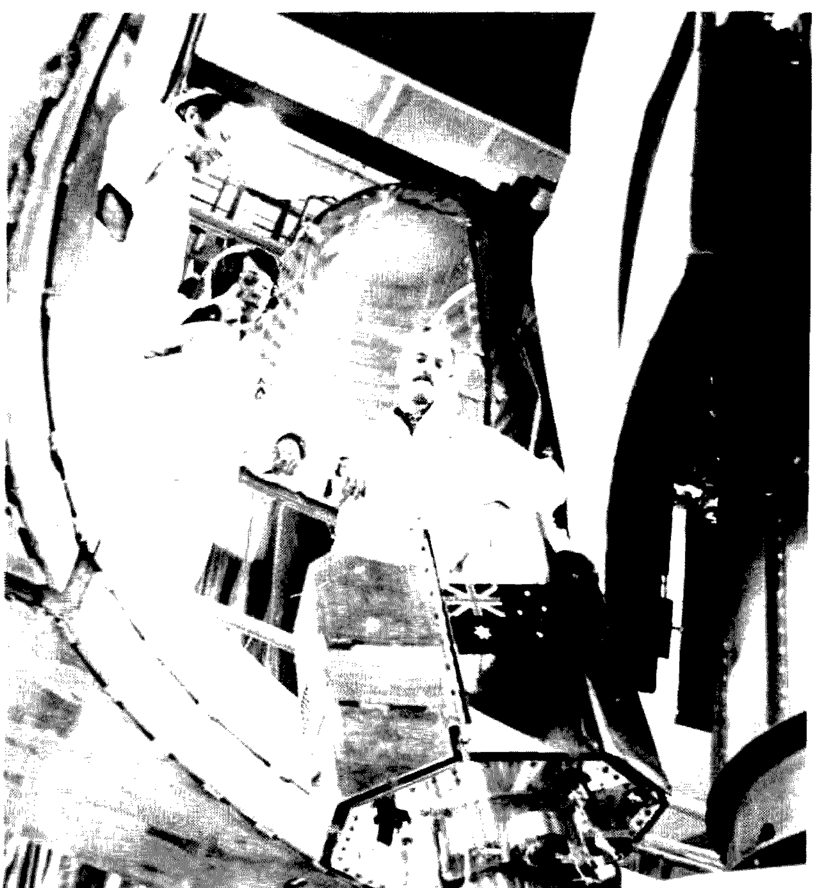
Join AMSAT. Learn more about how you can participate with the exciting AMSAT OSCAR 6 communications satellite, and with OSCAR 7 which promises to be even better. Receive the quarterly AMSAT Newsletter with the latest information on this new ham radio frontier. For membership information, write the Membership Committee, AMSAT, P.O. Box 27. Washington. D.C. 20044.



W6OAL, K3JTE and WA4DGU in front of the Delta vehicle gantry at the NASA western test range, Lompos, Ca.



Marie Marr (AMSAT aerospace technician) and Jan King W3GEY A-O-B project manager prepare AMSAT-OSCAR B for solar simulation test.



OSCAR 7 as it sits on the Delta 104 Rocket beneath the ITOS-G weather satellite.

OSCAR 6

Orbital Information

Orbit	Date (Jan)	Time (GMT	Longitude of Eq. Crossing °W
10110	1	0104.6	64.6
10122	2	0004.5	49.6
10135	3	0059.5	63.3
10148	4	0154.4	77.0
10160	5	0054.3	62.0
10173	6	0149.3	75.7
10185	7	0049.2	60.7
10198	8	0144.1	74.5
10210	9	0044.1	59.4
10223	10	0139.0	73.2
10235	11	0038.9	58.2
10248	12	0133.9	71.9
10260	13	0033.8	56.9
10273	14	0128.7	70.6
10285	15	0028.7	55.6
10298	16	0123.6	69.3
10310	17	0023.5	54.3
10323	18	0118.4	68.0
10335	19	0018.4	53.0
10348	20	0113.3	66.8
10360	21	0013.2	51.7
10373	22	0108.2	65.5
10385	23	0008.1	50.5
10398	24	0103.0	64.2
10410	25	0003.0	49.2
10423	26	0057.9	62.9
10436	27	0152.8	76.6
10448	28	0052.8	61.6
10461	29	0147.7	75.4
10473	30	0047.6	60.3
10486	31	0142.6	74.1

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

From Ray K5ZMS/5, "If you want to see Heath put another 6 meter SSB transceiver on the market, you had better heed what Mr. J.E. Shafer K8DCE, Communications Product Manager of Heath, says. In a letter to me recently he stated that customer correspondence is their best aid in planning new products! Get the hint? He said also that they have been considering a new 6 meter SSB transceiver, but as yet no decision has been arrived at. So, get on the ball and help them make a positive decision for 6 meters. Drop them one of your QSLs and tell them that you want to see such a product of theirs back on the market. Write to Mr. J.E. Shafer, Communications Products Mgr., Heath Company, Benton Harbor, Michigan 49022." I note in the most recent Heath catalog an Electronic Engineers Wanted column requesting applications for, among other things, "Communications Products Design Engineer – BSEE with 2-5 years in solid state circuits, SSB and FM modes, VHF and digital logic." A little reading between the lines yields a very pleasing possibility.

Harold WØLFH writes from Algona, Iowa to say he has picked up a pair of E.F. Johnson 30 W, 48 MHz AM transceivers and plans to modify them for 6 meters. Anyone active on 6 AM might want to drop Harold a line at 602 W. Nebraska and let him know about the local activity and perhaps set up a schedule with him.

WB4OSN told me during an opening last Sunday that October had been very poor in Florida. The only DX was a midmonth contact with TI2NA. Bob W4GDS confirmed the situation. The following evening the band was open here to Mexico, Utah, Arizona, Nevada and California. Tuesday evening (10/29) W7VDZ was in running 5-8 with absolutely no evidence of any other activity on the band.

George WA1PDY and his friend John WA1SCG set up a portable station on a lookout tower in the center of Cape Cod the first weekend in August. They ran an HA-460 from a car battery and fed the 8 W into a pair of 3 element Hilltoppers. The beams were about 35 feet off the ground at the highest point on the Cape (250 feet). The longest distance covered was to Sioux City, Iowa. . . over a thousand miles. Other states worked included Ohio, Michigan, Wisconsin, Tennessee, and Indiana. They never received less than a 5-8 report. . .not bad for the power level in use. George takes pleasure in pointing out that it doesn't take fancy or expensive equipment to have fun working skip, his expenditure for the HA-460 was all of $40.

Several weeks ago I received a letter from a company in northern Illinois stating they were specializing in 6 meter gear and reciting all of the items in stock. Included in this list was the Yaesu FT-620B. I immediately wrote the gentlemen and inquired about this particular item . . .I am still waiting on the reply. It just so happened that in the same mail I had received a letter from Fred DEEG K6AEH, Marketing Manager for Yaesu, stating that the situation with the FT-620B had remained status quo since my initial inquiry early last spring, April as I remember. At that time Fred had told me that there was but one prototype in the country and that the plans for importation were still very much unsettled with plans (at that time) to introduce it to the American market in the Fall. While there may be a few in the country brought back by individuals, general distribution plans are not set at this time. You will read it here as soon as they become available.

I understand W1HDQ is back at the helm with Bill Smith running for director. . .(if you can't say anything nice, don't say anything). . . .WAØABI

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Lennie Fekula
Rd 1
Hickery PA 15340
Telephone 412-356-7316

J. E. Keezer
25 E Elm St. Box 395
Central Islip NY 11722

K. Baker
11 Scotch Pine Drive
Central Islip NY 11722

John Stringos, Jr.
732 Princeton Blvd.
Lowell MA 01851

Mrs. Shirley Johnson
46 East Tamarack St.
Central Islip NY 11722

Basil W. Polinchak Sr.
SV Sta Box 81
Andover MA 01810

Tim Johnson
3965 Geist Road – Apt. E5
Fairbanks, Alaska 99701

Mr. James H. Pruitt
R. R. #4
Zelma MO 63787

Mr. and Mrs. Royce Carl
5806 114th N.E.
Kirkland WA 98033

E. Karl
63 Cranberry St.
Central Islip NY 11722

Al Bauer
141 Hawthorne Ave. 306
Central Islip NY 11722

Amateur Radio License Classes are being started. Instructors needed. All who are interested young, old, male, female, write Amateur Classes SV Sta, Box 81, Andover MA 01810 or call 685-3910.

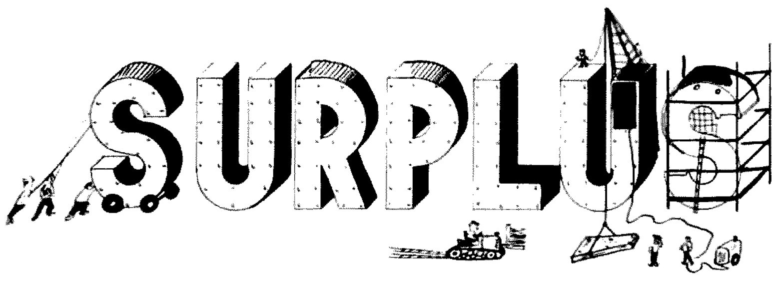
BASIC PHYSICS

MURPHY'S LAW – If something can go wrong, it will.
PARKINSON'S LAW – Work expands so as to fill the time available for its completion.
WELLER'S LAW – Nothing is impossible for the man who doesn't have to do it himself.
FINAGLE'S LAW – Once a job is fouled up, anything done to improve it makes it worse.
McGURK'S LAW – Any improbable event which would create maximum confusion if it did occur. . .will occur.

CRYPTOGRAM

WPBQBCQW, RUT PYJJ FKXQ VU WYDFEL TVJQLL RUT SYDFE SUW EFQB KVA LEYZH TI EFQB. – VLA.

Remember, you will have no rights unless you fight for them and stick up for them.



Bill Turner WAØABI
Associate 73

The latest issue of "THIS MONTH", a flyer published by Herbach & Rademan, 401 East Erie Avenue, Philadelphia, Pa., 19134, has a number of items of interest for any confirmed scrounge. I would imagine the 10½ inch reels of ¼ inch recording tape won't last long if automatic repeaters become a reality. These have the standard hub, not the NAB type and are full of 1 mil polyester low noise tape and are stated as having been used once or twice. The reels are fiberglas and should last forever. This is a bargain for the reels alone, as is each reel will record 12 hours at 15/16 ips or twice as long if the tape is replaced with .5 mil Mylar. If a multitrack head is used the time becomes fantastic. Putting these to use isn't as complicated as it might at first seem. The takeup and supply motors of any three motor tape deck are easily repositioned to accomodate the larger reels, other decks can be modified by the addition of two phonograph motors and a little hub fabrication. The price is $3 each or 10 for $20. The minimum order is $7.50.

Another goodie from the same source. . .a clock motor with outputs at 1 RPH, 1 RP12H and 1 RP24H to make a combination local and Zulu clock. With hardware and cord, less hands and face, made by Ingraham, $3.50.

Poly Paks is advertising the PCB for a 12 digit calculator, a first to my knowledge. Everyone who has been putting off building one may now have at it with reasonable assurance of success. Also available are the keyboard, the chip and DIP resistor networks to match. The chip is the popular Cal-Tech CT-5001 with decimal switchable to 0,2,3, or 4 places, leading zero blanking, overflow, negative sign and chain capability. The PCB is $3.95, keyboard $6.95, resistor networks $1 each (two required) and the chip is $5.99. A wide range of LED alphanumerics are available too. These run from .1 inch magnified to .7 inch direct view. Naturally red, green and yellow are available.

To disgress for a moment, the author has had occasion to work with some orange discrete and seven segments of late. These are not on the market as yet but it won't be long. Another innovation on the way is a discrete with the die mounted in the center of a reflector. The result is a much brighter LED with the appearance of a bright spot with an equally bright halo. . .most impressive.

Electronic Distributors, Inc., 4900 N. Elston Ave., Chicago, 60630, has several items too. How about some horizontal mount PC coil forms at 29 cents each or four for $1? These are 7/32" diamater by 1 1/16" long, come equipped with four terminals and a ferrite slug. For those devoted to plug-in coils there are 5/8" diamater by 1¼" forms with the mating socket for 29 cents or 4 for $1. The forms alone are 19 cents or 4 for 60 cents.

Could you use a brand new UHF TV tuner for $3.95? These are similar to the units used in the FM and Repeater Handbook 420 converter.

Need cheap components? How about resistors preformed for PC boards for ½ cent each? (200 for $1). These are assorted and of the several packages received there were perhaps 30 values, these were all popular values by the way, nothing way out. The quality is as good as you can buy, many were 5%.

Need some line cords. . .good ones. . .6 feet long, the same source has them for 20 cents each (5 for $1). Assorted slide switches at 10 for $1. 250 solder lugs, 20 resistors, 5-10-20 W types, 500 assorted rivets? All of these items are available from Brooks Radio & TV, 487 Columbus Avenue, New York 10024. The minimum order there is $5.

Digi-Key Corporation, P.O. Box 126, Thief River Falls, Mn. 56701, has MPF102's for 44 cents each or 10 for $3.80. . .a bargain on a very useful and universal item. Another goodie. . .1 MFd to 100 MFd electrolytics run 14 to 19 cents each in single lots dropping to 12 to 15 cents in lots of 10.

Need a dual 5 amp power supply? One is fixed at 12 V, the other is variable from 0 to 42 V. Everything is included except the case and metering. Transformer, 2 bridge rectifiers and filter capacitors switch, line cord, pilot light. . .all the pieces for $22.50 from Delta Electronics Co., Box 1, Lynn, Mass. 01903.

WAØABI

PAST GOOFS

W5LCT CORRECTION

I was greatly impressed with ingenuity that Earl C. Dunn, Jr. W5LCT used in deriving his selective call system as appeared in 73 Magazine October 1974, Page 51. I was so impressed with the simplicity of it that I am going to incorporate it into a decoding system that I am building now.

In studying the drawings, I found an error on page 54, Fig. 3. Pin 3 of the 7402 should be connected to pin 12 of the same IC. Without this connection the circuit will not activate the relay.

I have drawn many logic circuits and have found errors of this type very easy to make while copying a circuit for a friend.

I read 73 Magazine from cover to cover and enjoy every word. Thanks and keep those logic circuits, as well as others, coming.

N. Blahos
WA3IUQ/N0RON

W2OC CORRECTION

High-Low Frequency Monitor, Fig. 1, page 110, Nov. 74 issue of 73 Magazine.

R8, 6.8 K resistor should be 4.7 K and bottom end in schematic should connect to +5 V, *not* ground.

JULY 74 CORRECTION

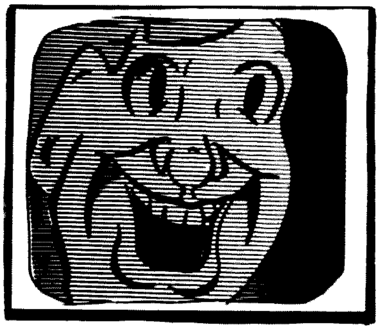
There is a misprint on page 72, Fig. 4.

It should read:

Note: Run Neutral of 220V to transformer's *only* if operating two 110V unbalanced primaries in series. *Do not fuse common line.*

Ed Hartz K8VIR

SSTV SCENE



Dave Ingram K4TWJ
Rte 11, Box 499 Eastwood Vil. 604 N.
Birmingham AL 35210

Welcome to 1975 – the 50th Centennial Year of Television. As you may have heard, either on the air or from previous SSTV Scene columns, I am planning a re-activation of 1925 style television as a nostalgic interest project. These TV signals bear a resemblance to the early amplitude modulated subcarrier used in Slow Scan TV, but receiving apparatus is much simpler. Watch for more details on this as the year progresses.

Inflation is a major subject this year with soaring prices on everything imaginable. Food is so expensive that it's cheaper to eat money and even commercial ham equipment has crunched the kilobuck range. I seriously believe the only item to drop in price this year will be the MOS shift register. Bulk production of these chips, and many popular ICs, may place items like the SSTV Keyboard, the Fast to Slow Scan converter and Slow Scan's outstanding item for 1975, the Slow to Fast Scan converter within comfortable reach of all home brewers. Printed circuit boards for these items are now available thus assuring success to even the inexperienced amateur. Placing components in the proper board holes is quite simple and if each capacitor, resistor, transistor, etc., is checked briefly before installation, success is obvious. The main PC board designers at this time are WØLMD and W6MXV.

Possibly 1975 will be the year Slow Scan will prove itself during unfortunate emergencies.

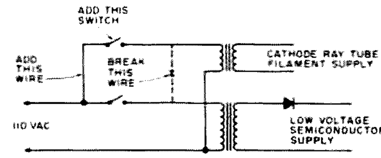
Watch for one or two new companies to enter the Slow Scan field, one possibly using an electrostatically deflected unit.

As usual, the Dayton Convention this April should prove a gold mine of knowledge, so plan now to attend.

I think we may get Wayne Green active again on Slow Scan – showing ideas and making faces. FM may be fun but Slow Scan is sensational.

W6MXV Scan Converter Announced

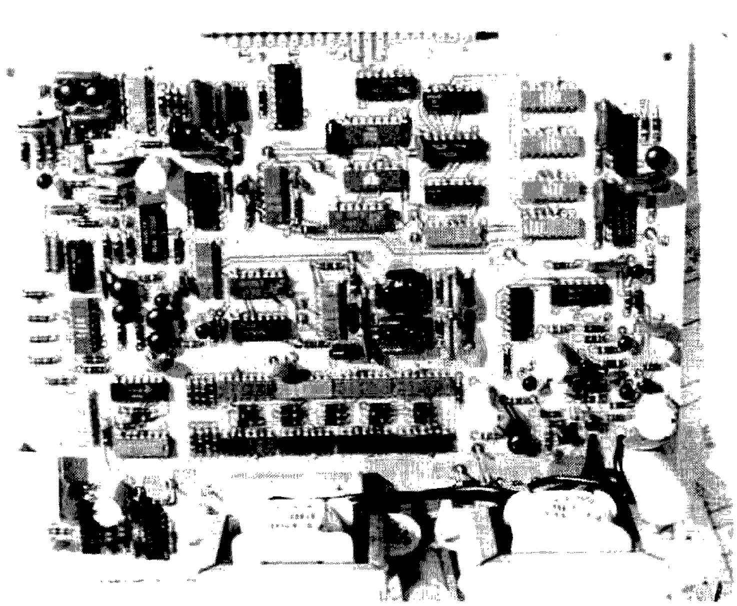
Mike Tallant W6MXV recently sent us a package of information on his new Fast to Slow Scan converter which has some outstanding features. This unit connects to any regular Fast Scan camera and outputs directly with Slow Scan TV. Absolutely no modifications to the camera are required. The unit boasts black to white inversion capabilities, partial frame scans, built in gray scale generator and more. The converter may be powered from 110 or 220 V mains, and 50 or 60 Hz operation is selected by one jumper



on the PC board. His demonstration tape revealed very good quality pictures which swung nicely from absolute black to peak white. I also noticed the five step gray scale calibration display could be switched to mix with any picture. Mike is producing PC boards and kits of this unit and, like his monitor, they are top quality. The glass boards, complete with gold plated connector strip, are 35 dollars. A complete kit of parts less cabinet, knobs and power cord is 175 dollars. Wired and tested boards are also available for 235 dollars. Future plans include a complete camera with sampling adapter, through viewfinder and F lens at a competitive price.

Help A Transistor

Here's a helpful suggestion for those of you with solid state monitors, either commercial or home brew. Try connecting the cathode ray tube filament transformer so it may be switched independent of the solid state circuitry, like in Fig. 1. This "standby" and "operate" modification gives "instant on" capabilities plus relieving any unnecessary strain on deflection transistors. Many Slow Scan monitors do not produce a raster when they are on and not receiving an SSTV signal. This means the cathode ray tube's electron beam is deflected to the edge of the screen. When this



The W6MXV scan converter board.

happens, two deflection transistors are cut off and the other two are conducting heavily. Naturally this condition doesn't boost transistor life. My simple modification eliminates this possible problem.

Ramblings

This month's pictures were snapped off the monitor by Gene W1VRK. The pictures of his son and daughter examplify the high resolution obtained on Slow Scan TV (and Gene's superb photography).

The Slow Scan contest is happening again next month, so plan to join in the action. Full details will appear in next month's column.

...K4TWJ

LETTERS

DESTROY ALL CLUES

Right now you have in your files hundreds or thousands of letters on your courageous stand against the IRS. Before they get any smart ideas and suppoena those letters to use against the letter writers, why don't you cut off any clues to their origin such as name and address? A comment to that effect in your wonderful editorial would have many hams sleeping easier at night. Big brother is still watching.

Clive Frazier K9FWF/4

All names are clipped off letters with IRS info to protect the writers so there is no problem. I have a whole file cabinet now devoted to cases of IRS harrassment reports — and clippings or letters with more will be appreciated as this is developing into a fantastic book. I note that the IRS chief now says he wants to stop persecuting Mafia — presumably to free agents to do jobs on citizens less able to fight back using the same police state tactics granted to IRS to get the Mafia...ed.

RECRUIT RECRUIT RECRUIT

I enjoyed WA1GFJ's "Buy Buy Buy" article in the October 73 because it states the kind of truth we hate to admit and rarely sees in print. May I suggest however there is a corollary which Gabe omitted — and that is: Recruit Recruit Recruit! Stop and think, most of you bought rigs when you were new in ham radio. So get busy at the local ham club and the boy scouts, set up code and license classes, bring in new hams. Recruit!

Wally Thompson WB5IUL

LDEs

I read with great interest the item on page 12 of the November 73 on "Long Delayed Echoes." This little understood phenomena has been my field of research for several years. Using a General Electric P-7 self cleaning transmitter on 5 million meters, I too have heard echos.

Signals are initiated by sending the code sequence BS at 60 wpm. The time period of the echoes can be predicted from the formula $T=3.14159\frac{APQ^2}{D5}$ where T=time in seconds, A=angle of radiation in Hours of Right Ascension, P=pulse rate in Bauds/Fortnight, Q=the density in quasars per cubic parsec, and D=the distance in light years.

Using the graphical solution as suggested by Lunan, but substituting semi-logarithmic circum-polar coordinates, the results always appear to resemble the constellation of Taurus.

By the way, the Mono-Reproducer was incorporated in the receiving setup, and provided the necessary gain to receive the weak echo returns. Thanks for the fine construction articles. Who said all hams are appliance operators?

Henry Testa K8MUF

FAN MAIL

Your present editorials are mostly dull and without life. I remember them from years back where you gave everything and everybody hell.

Kurt Bittman WB2YVY

NATIONAL CONVENTION

Please advise the writer of "Convention Critique" on page 3 and 4 of the October 74 issue of 73 Magazine that we appreciate his comments very much. Further advise him the 1976 National ARRL Convention is being held in Denver, Colorado at the Hilton Hotel. His challenge to "Philly" to do better is unnecessary. The ARRL has officially picked Denver for the '76 convention.

B.R. "Slats" Council KØATZ
General Chairman
1976 National ARRL Convention

THE VALUE OF X IS...

Why is the X skipped over in all call areas when calls are assigned? Why doesn't W3XAA follow W3WZZ instead of W3YAA?

Ronald Fields WN3WEE

X is for experimental stations only... wayne.

EXPLAIN, PLEASE

I have noted your attempts to improve the best ham radio magazine presently published in the U.S.A. I read your requests for contributions from your readers with some frustration; I am a priest first, a ham radio operator second!

Like many other of your readers (I suspect they are legion) I too like to build and to experiment with the new electronic wonders that are being offered in the pages of your great magazine. One of the problems for many of us in ham radio who are not actively engaged in the field of electronics professionally is that we don't know what all those little bargain gadgets are! Today, I was rereading the November, 1974 issue of 73 Magazine; you'd be surprised, Wayne, at the things one can learn by just reading, rereading and reading again the pages of any given issue of 73! On page 40 I found that article by W2AOO about impressing your friends with a digital wind direction indicator.

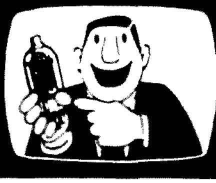
I was much impressed (never mind my friends)! I was all set to try it, then I realized I didn't know what a SN7404, SN7442 or even an LM309K are! I did find what appeared to be corresponding numbers listed in the ads in the back of 73.

That's the whole trouble in a nut shell, Wayne! I don't really need a wind direction indicator to impress anybody; what I do need is someone to tell me what all those "goodies" are that are being advertized at such bargain prices in the back of the 73 Magazine! If there are other readers in the same state of the art as I, then there should be a great potential for an article on just what all those goodies are and what one can do with them. Can you imagine all the sales that would accrue to your back page advertizers as a result of it?

Thanks, Wayne, for reading one more suggestion, and especial thanks for doing something about it!

Fr. R.O. Gardiner W6LZJ
Long Beach, California

OK, Father. Good suggestion. We'll try to get some info on this...wayne.

NEW  PRODUCTS

WAHL QUICK CHARGE IRON

Wahl has added a third iron to their line, one with fast charging Nicads which will charge in about one third the normal time! An hour or two will bring a weak iron up to strength and four hours will bring it up to capacity from fully discharged. Wahl Clipper, 2902 Locust, Sterling IL 61081.

CANADIAN HAM REGS

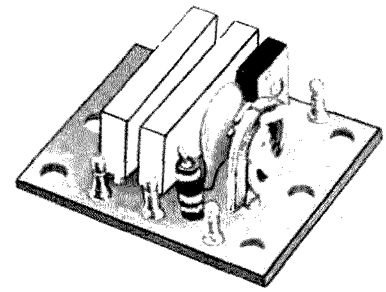
The Canadian Amateur Radio Federation has out a completely new edition of their Radio Regulations Handbook. This book has the regulations and guidelines for all types of amateur operation including RTTY, TV, remote control, fax, repeaters, etc. Send for your copy, $4, to CARF, Box 356, Kingston Ontario K7L 4W2, Canada.

160 RISES AGAIN!

One of the big movements in recent months has been the resurgence of interest in 160 meters – and one company in particular has been making this easy for amateurs: Dentron Radio, North Olmstead, Ohio. The Denton 160 Meter Transverter works with any 80 m transceiver, SSB, AM, or CW, with 100 watts input to the final 6146 tube. It will work with as little as 5 watts drive. The 160XV is very simple to use, requiring only two connections to your existing station. The unit sells for $199.50.

Dentron also has an antenna tuner available which will help you load up just about anything and get a good signal out. The 160AT tuner sells for $49.50. Some ops are loading up their tower, their 80m antennas, and even window screens with this tuner. For further info write to Dentron, 27587 Edgepark Drive, North Olmstead OH 44070.

With this setup you can find out for yourself why so many old time ops think that 160m is one of the best phone bands we've ever had.



TINY TONE ENCODER

The fellows at Alpha have been at it again with their miniature shoehorn, cramming all sorts of nice things into almost nothing. This oscillator will run from 20-3000 Hz, is set on frequency by a laser trimmed module and draws about 4 mA at 12 V. Note this one unit will go from subaudible to tone burst frequencies. Alpha Electronic Services, 8431 Monroe, Stanton CA 90680.

MIDLAND RSVP PROGRAM

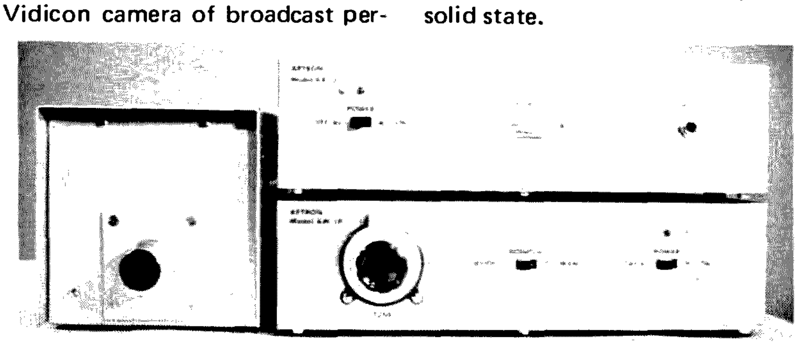
Midland has announced a plan for contributing $10 to the repeater group of your choice when you buy a Midland 2m rig. You get an RSVP card along with the 13-500 (15 Watt 12 channel) or the 13-505 (30 Watt 12 channel) rigs ($250 and $300 respectively). The card is returned to Midland when a rig is purchased and they send a check to the repeater you designate.

450 MOBILE ANTENNA

Antenna Specialists has a new one for 450 – wideband tuned for repeater use and capable of handling 150 Watts. The ASP-830 has a pair of 5/8 wave elements in a vertical colinear design for a gain of 5 dB. Antenna Specialists, 12435 Euclid, Cleveland OH 44106.

HAM TV EQUIPMENT

Aptron, of Bloomington, Indiana, has introduced a complete line of ham television (fast scan) equipment. This includes a Vidicon camera of broadcast performance, a 10 W aural/video transmitter, and a converter for using your home television set for monitoring and receiving. . .all solid state.



Caveat Emptor?

PRICE – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.
Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.
We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.
For $1 extra we can maintain a reply box for you.
We cannot check into each advertiser, so Caveat Emptor . . .

TECH MANUALS for Government surplus gear – $6.50 each: R-274/FRR, R-220/URR, URM-25D, CV-591A/URR, CV-278/GR, TRM-1, TS-382D/U, TS-497B/URR, TT-63A/FGC, URM-32. W3IHD, 7218 Roanne Drive, Washington, DC 20021.

CALCULATOR OWNERS: Use your +-x÷ calculator to compute square roots, cube roots, trigonometric functions, logarithms, exponentials, and more! Quickly, accurately, easily! Send today for the IMPROVED AND EXPANDED EDITION of the First and best calculator manual – now in use throughout the world. . .still only $2.00 postpaid with unconditional money back guarantee! Mallmann Optics and Electronics, Dept. -E7, 836 South 113, West Allis, Wisconsin 53214.

JIG SAW PUZZLES wanted. If you have any old wooden jig saw puzzles in your attic – or run across them at an auction (they go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck apiece for them. c/o 73 Magazine, Peterborough NH 03458. Wood, not cardboard – and complete.

CALL LETTER LICENSE PLATES – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate – most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

COLLECTOR is interested in books, autographs and other information on early radiotelephone pioneers. Ronald Phillips, 1925 Baltimore, Kansas City, Missouri 64108, (816) 842-9009.

DAVENPORT, IOWA announces their Fourth Annual Hamfest, Sunday, February 23, 1975, at the Mount Joy Airport, north of I-80 (Brady Street exit) on Highway 61. Advance tickets, $1.50; door, $2.00. For tickets or information write KØHSC, 1711 West 15th St., Davenport, Iowa 52804.

FREE: 12 Extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Ten-Tec, Kenwood, Swan, Atlas, Standard, Clegg, Icom, Genave, Tempo, Venus, Alpha, Hy-Gain, CushCraft, Mosley, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812) 894-2397.

FM-YOUR KNIGHT TR-108 Complete kit. Use xtal-vfo. 19.95ppd. Check or M.O. Calif. res. 6%. Revilo Color, 4725 W. Washington Bl., Los Angeles, CA 90016.

FOR SALE: Heathkit DX-60B Transmitter & HG-10B VFO, mint condition, $65. Richard W. Morofsky, PO Box 11, Nemacolin, PA. 15351, (412) 966-5525.

WANTED: Vibroplex keyer paddle in good condition. State price. D. Lehto WA7WOC Box 1411, Carefree, Arizona 85331.

SELL UNIQUE WIRE TUNER like new $45 Box 8352 Savannah, Georgia 31402.

TWO PLASTIC HOLDERS FRAME and display 40 QSL's for $1.00 or 7 holders enhance 140 cards for $3.00 – from your Dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin, Tennessee 37066.

STANDARD 146A – 3 months old, with 94/94, 34/94, 73/73, 25/85, 16/76, nicads, charger, rubber ducky and 2 whip antennae, external mike, 2 leather cases, $300.00. Mike Arseni, WA2WCB, 30-91 Crescent St., Astoria, New York 11102. (212) 626-7817, after 1800.

NC303 RECEIVER with 2&6 meter converters in seperate cabinet, $350.00; Ameco TX-62 xmtr and VFO Model 621, $175.00; Seneca Heath xmtr. 2&6 meters, $125.00. Write Box J, 73 Magazine, Peterborough, N.H. 03458.

YOUR SWAP-N-SELL ads run free in TRADIO, a public service publication of Wichita Amateur Radio Society, Box 4391 Wichita Falls TX 76308.

FROM UNIVERSITY-Sound 4 C 15 W Woffers in unopened cartons. Retail $169 each. Will sell at $1.00 each. Write Cassette Headquarters, P.O. Box 482, Jaffrey, N.H.

NOW PAYING $2000.00 and up for ARC-94/618T, ARC-102/618T. $1200.00 and up for ARC-51BX. $1500.00 and up for 490T-1 antenna couplers. We also need these control boxes – C-6287/ARC-51BX, C-6476/ARC-51BX, C-714E-2. We also need R-1051 receivers, RT-662/Grc-106 transceivers. We buy all late aircraft and ground radio equipment. Also pack radios. We are buyers not talkers. Bring your equipment in, you are paid on the spot. Ship it in, you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment, call us. Call collect if you have and want to sell or trade. We also sell. What do you needD&R Electronics, R.D. 1 Box 56, Milton PA 17847. Phone 717-742-4604. 9:00 AM-9:00 PM.

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding, literature Estes Engineering, 543-A West 184 Street, Gardena CA 90248.

TWO-METER FM ANTENNAS, ¼; 5/8W "CARTOP" & Fixed station. Unique designs. Send for literature. MARSH Devices, P.O. Box 154 (a), Old Greenwich, CT 06870.

MOTOROLA PORTABLES – Expert repairs, reasonable prices, fast turn-around time. More details and flat rate catalog FREE. Ideal Technical Services, 6663 Industrial Loop, Greendale, WI 53129.

AMSAT/OSCAR 6-7 SLIDES – set of 5, $1.25 Lift-off and equipment Proceeds AMSAT. K6PGX P.O. Box 463, Pasadena, CA 91102.

DAYTON HAMVENTION at HARA Arena April 25, 26, 27, 1975. Program brochures mailed March 10th. Write for information if you have not attended the last two years to HAMVENTION, P.O. Box 44, Dayton, Ohio 45401.

WANTED: Hallicrafters SX-88 for parts, any condition considered. KØMNA, 4805 Sullivan, Wichita, Kansas. 67204.

More on Page 122

GUEST EDITORIALS

Does Ham Radio Have an Identity Crisis?

Is it possible for hobbies — like humans — to have an identity crisis? Does it seem reasonable that Amateur Radio might be going through the same conflicts, uncertainties and insecurity experienced by people during adolescence or middle age?

Why not? It's nothing to be afraid of as long as it is dealt with candidly and competently. Let's look at some of the symptoms.

Projection. . .shafting someone else for characteristics we all share. One example is the attitude towards GRS or citizen band operations. Comment on the air has included put-downs of CB vocabulary and style. Is Amateur Radio somehow supposed to feel better about itself, enhancing our image through ridicule? Listen to 75 and 2 sometimes!

Defensiveness. . .usually about an issue internal to ham radio. It is often seen in attempts to explain away limitations in knowledge or skill in order to offset elitism. There should be room for a variety of gifts and interests without feeling intimidated as an "appliance operator", or being more interested in Phone than CW. Instead of feeling hassled or humbled why not do something about developing updating programs for licensed operators.

Anxiety. . .almost bordering on paranoia, this feeling is usually directed towards such issues as U.S. frequency allocations, aggressive special interest groups and alleged competition in ham organizations.

Cynicism. . .observed when community service projects are discarded as mere ego-trips and sincere efforts to improve the hobby are described as being idealistic.

There are other symptoms, but perhaps the point has been made. And organizations, like individuals, have to learn how to get beneath the symptoms to the underlying causes if answers to the questions "who are we," "where are we going?" are to be found.

The prescription might include cooperation with GRS types (there is one such story in "Operating NEWS"). Why not a field exercise, a community project, even a fraternal delegation to the forthcoming convention? And we can all benefit from a systematic program of skill development. *TOA* will do its share through articles and announcements of opportunities to continue our training. The antidotes for anxiety and cynicism abound. . . there *are* appropriate channels through which our views and interests are presented. . .there *are* individuals and clubs setting high standards of community service. You can support the hobby, help it through its identity crisis in a dozen ways better than brooding and brawling on the bands.

Where is Amateur Radio going? The soundest way to deal with the question is to indentify the issues, evaluate our strengths and weaknesses honestly, and take positive, cooperative and corrective action.

Now.

The Editor
The Ontario Amateur
P.O. Box 334
Toronto, Ont. M8Z 5P7

RF NEWS

Ever heard of Project Sanguine? Or. . .HEMAC?

Did you know that live trees can be operated as a high frequency antenna system?

Read on!

One of the most controversial technical projects is the U.S. Navy's Sanguine program. Basically, it depends on an antenna which is more or less square. Each side of the antenna is 40 to 80 miles long. Even though it is intended to be buried in the earth, naval planners are running into opposition from residents wherever they turn for site planning.

Claiming "environmental" as well as other reasons, people all over just don't want the thing near them. Practically speaking, they do have some cause for concern, as the antenna location could turn out to be a target for enemy missiles.

The reason is that the antennas are part of a long range super-secure communications system. They are intended to convey messages to submerged submarines anywhere in the world.

But the technical aspects of the installations are as interesting as the proposed uses for the equipment. The carrier frequency would be somewhere between 45 to 75 Hz! The rf would be transmitted through the earth's horizontally polarized E field. Submarines, in turn, would be trailing long wire (REALLY long!) antennas. A great deal of the antenna overall length would be shielded in order to get the actual receiving portion out and away from the submarine's own electromagnetic noise field.

The operating range of such systems and at such frequencies is typically about 2,500 miles. Because the antennas, even with their 40 to 80 mile length would be short, they must be insulated from conductive earth. For this reason, planners are seeking sites with large areas of rock shelf, like those which exist in Texas, Wisconsin, Michigan and a few other sites.

Overall output of the system

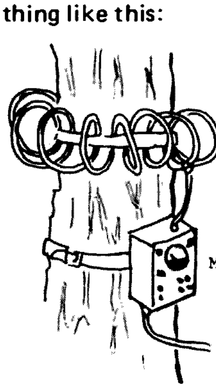
will be on the order of 10 megawatts, based on the use of a grid of 100 amplifiers putting out 100 kilowatts each. Thus, even if several transmitters were disabled for any reason, the remaining ones could continue to power the antenna.

Actual messages will be sent in encoded form using MSK (or minimum shift keying). Navy experts feel that jamming would be next to impossible and probably only result in a slight delay of received messages. Two enemy jammers would actually be required, each at twice the power of a Sanguine system, to affect all operational areas. Now let's get back to that teaser. . .using a pair of trees as a phased antenna.

Yep, it really works! The technique of using a "hybrid electromagnetic antenna coupler," or HEMAC, is credited to Kurt Ikrath, an antenna development specialist working at Ft. Monmouth, N.J.

It all began when the army realized it had difficulty getting HF signals out of jungle growth and heavily wooded areas. The army relies a lot on walkie-talkies or back-pack radios which operate all over the HF spectrum, and which use vertical (whip) antennas.

Well sir, Dr. Ikrath's HEMAC solves the problem just dandy. Essentially, HEMAC consists of a toroidal loading loop and an input matching network. It looks something like this:



Dr. Ikrath says: "You can get radiation out and over the forest, and the improvements have been measured at up to 22 dB over that of a comparable whip antenna, particularly in wet jungles. We've used two trees, four meters apart, as an HF phased array in the Ft. Monmouth area."

By changing the phase difference between the voltages driving the two trees, he was also able to vary the radiation pattern.

But the use of live trees is not the end of the story. Metal utility poles. . .and a human body have also been used. The problem with a "person antenna," he says is that you cannot couple to the belly. "You have to couple to other parts of the body," he says. Fat people, he has found, make better antennas than slim ones. . . and the pattern from the body is highly directional. No explanation for that one. . .yet.

Ed Bruening W8DTY
Reprinted from
Action Magazine
Box 187
Grass Lake MI 49240

QRPP MOBILE

Here is a report long overdue, as promised several months ago on QRPP mobile on Manor Lake. I originally planned to use my canoe and see what would happen. For convenience the plan was slightly modified. The boat my 12' Star Craft Pram outfitted with a 6HP MOTOR along with an electric motor powered by a 12 volt auto battery was substituted. The antenna used, a hustler mobile mounted to the bow with 20, and 15 meter resonators. The rig an Argonaut 5 watt input. One hand key an astatic mobile microphone. The plan was simple, from my camp site on Manor Lake, "part of Penn Manor Club", I motored out to the middle of the lake dropped anchor and was ready to go. Using the auto battery as power the rig took the load of the mobile antenna just fine. I started on 20 meter phone and worked Texas, and California in about 30 minutes of operating. Then switching to 15 meter phone no contacts were made, but several stations were heard. Going to 15 CW a little more success was had. One novice in Alabama just could not believe it. On 20 CW 5 stations were worked with average report 479. The total time spent just over two hours. Getting the rig back to dry land I finished the day fishing. The antenna removed easily. Seems like a practical way to blend my two favorite hobbies, QRP and fishing. The rig used is a bit expensive to use precariously; I am again modifying my HW7 which will eventually be my knock around rig. Future plans call for the HW7 to be my main portable rig, and in particular mobile CW on 20 and 15. But I suspect a power supply separate from auto supply will be necessary while in motion.

In summary my objective was met. I spaned easily 3,000 miles East Coast—West Coast. There is no doubt in my opinion considerably less power could have been used with equal success. More attention to the time and frequency used is far more important than power used. In all fairness I should report more stations failed to respond to my call than did. But that is the fun of it. At home I expect all stations to come back as I have an elaborate station with plenty of power. This just makes it more sporting and that is what it is all about. In my case at least.

Bob WA3HBT

Reprinted from the
X-Mitter
Penn Wireless Assn.
138 No. Bellevue Ave.
Langhorne PA 19047

THE PIRI REIS MAPS

As members of MARCO are aware, I am a geophysicist and admit of very little knowledge of cartography. In the various disciplines of geophysics various types of maps must be used. I find myself employing topographic, geological and terrestrial magnetic maps, to name a few, but the most of these are based upon the well known Mercator projection. Seismology, at times, requires a special type of non-Mercator projection known as "stereographic." As a non-cartographer I am relay-

ing items that have been told me. I am not an authority!

Science is discovering that peoples of the past, and from many parts of the world travelled extensively in exploration. They charted their journeys and despite crude navigational equipment, produced excellent if not accurate maps. In the more "advanced" countries, especially in the Mediterranean area, maps were confiscated from an enemy and considered as valuable booty. Some of these come down to the present and cartographers are attempting solution of the various projections.

One of the common projections used prior to and during the middle ages is known as the "Portolano" projection. The name is of old Italian derivation and the maps gave sailing directions, port locations, coastal features and rhumb lines. These latter lines denoted compass headings but other vectors may have been designated. A latitude and longitude grid was not included, although principal cities were points of projection. The Piri Reis maps were of the Portolano type. Piri Reis (ca. 1500 A.D.) was an admiral of the Ottoman Empire and of a family famous for its' navigators. He wrote extensively on the maps prior and current to his time. In 1513, he supposedly compiled a map of the world, and having had a former sailor of Columbus in his employ utilized some of Columbus' maps. Columbus, in turn, is supposed to have used some of Reis ' maps during his trans-Atlantic voyages. Piri Reis copied from many older maps including some of Alexander's (356-323 B.C.) and some thousands of years prior to that warrior's time. His 1513 map of the world was lost, but recently, supposed parts of this work have been rediscovered.

Shortly after World War II, the U.S. Hydrographic Office found in its' files some ancient maps that bore little resemblance to modern projections. A Captain Arlington H. Mallery, engineer and cartographer, was called in and he recognized them as Portolano's and possibly parts of the Pire Reis 1513 map. Mallery was able to translate them to a Mercator projection. The portions including North and South America were very accurate, but the parts most interesting to myself were areas of Greenland and Antarctica.

Greenland, in this map is composed of three islands with a major fjord trending northeast-southwest and a minor one trending northwest-southeast. From recent seismic soundings we know that bedrock is thousands of feet below sea level in these areas. In certain areas of Antarctica where no land is shown on these ancient maps, seismic studies of mine in 1955-1956 shows land well below sea level beneath the ice of today. Later seismic surveys than mine demonstrated similar conditions. These findings of Captain Mallery and myself were presented at a Forum at Georgetown University, Washington, D.C. on August 26, 1956. The participants were Captain Mallery, a Mr. M. I. Walters, cartographer, and formerly with the U.S. Hydrographic Office, and myself.

Since that presentation, several fictional and pseudo-scientific books have quoted and misquoted this Forum to further their own theses. One theme that is recurrent, tries to prove the existence of extra-terrestrial explorers photographing earth areas from UFOs during preglacial times, or at least a million years ago. Some of the books refer to me as the "noted cartographer" who solved the projections. As stated above, this is quite inaccurate.

In closing, I believe that many of the Portolano maps are quite accurate and the ages ascribed them may be believed. Some may feel that the beginning of civilization in the western hemisphere began after 1492 A.D. We have extensive evidence in South America, at least, that engineering, medicine, surgery, the arts, etc. existed at least two millenia previous to Columbus. 1492 was not the year when the earth was proven not to be flat. Eratosthenes had proven it to be a sphere about the year 200 B.C. and his computed circumference of the earth compares rather closely to our present figure.

While it is possible that land and sea explorations were effected thousands of years ago and that these journeys were charted, I do have difficulties, in the light of our present glaciological knowledge, in believing that these early explorers found the polar regions completely stripped of ice cover. It is possible that some interglacial stages existed, even warmer than the present one, when explorers encountered a partial ice recession and gave the opportunity for the cartographers of those ages to extrapolate below the thinner ice of the time, and determine the land profile as we are doing it by seismic methods today. Some ice cores taken at great depths in Antarctica today have been dated to be hundreds of thousands of years old, which precludes a complete absence of ice.

Reverend Daniel Linehan, S.J.
W1HWK

Reprinted from the
Medical Amateur Radio Council
P.O. Box 229
Manchester CT 06040

WHAT DO YOU CALL ?

WHAT DO YOU CALL #?

Seems so simple doesn't it? Apparently there has been a problem everywhere on what exactly to call the "#", the symbol on the lower right button of the 12 button "Touchtone" pad. Well the people at Western Electric's Indianapolis Works, who have been producing the TT pads for years say the name for the # is "number sign". This was brought to light recently when a rumor began spreading indicating the correct name for # was "Octothorp" — this certainly is not true says AT&T, the parent organization.

Of course the subject could end there, and we could all start calling #, "number sign". But WA4JZX did a little more research on the matter. A check with about 25 universities and

several different departments within, including the reference libraries of many like: USC, UCLA, University of Colorado, NC State, UNC, College of William and Mary, Princeton, Old Dominion, etc. . .has revealed that the symbol actually has no official name, but has many uses including:

In Music. . . "sharp"

In Medicine. . . "fracture"

In Proofreading. . . "leave a space"

Preceeding a number. . . "number"

After a number. . . "pounds"

The closest actual name that has some geometrical logic occurred in one old dictionary at the College of William and Mary in Williamsburg, Virginia – that name is "crosshatch."

Looks like this just results in one more item for which the amateur must develop a "standard" name. Any more suggestions?

Reprinted from the Carolinas-Virginia Repeater Assn.

MOBILE THEFT: ARE YOU INSURED??

Each of us operating a mobile has a rather large investment in gear on display in our cars. Theft of this equipment would not only be a great inconvenience, but also a substantial loss. Most of us figure that somehow or other our insurance would cover such an occurance, but many of us are in for a great surprise. To find out facts concerning this, several insurance company claims adjustors were approached, and here's what was discovered:

1. Many policies have a rider that refers to "sound-reproducing" type systems. Ham radio is not excluded from a policy by this rider, as it refers to a tape system;

2. Insurance coverage which does nothing more than meet state requirements to buy license tags will not cover theft;

3. Collision/Theft Insurance is what's required, and it is available to cover a *permanent* installation;

4. Presence of a burglar alarm system, or call letter license plates have absolutely no bearing whatsoever on the decision of what is a permanent installation;

5. In the case of an under-dash installation, the case of the radio must be bolted to the car. Installations that slide in and out with clips to hold the set are NOT permanent;

6. For trunk mounted rigs with dash mounted control head, answers varied. Some adjusters said the rig would be covered, others said no.

If you are not sure about whether or not you are covered, the only true means of determining this is to take your installation and insurance policy to your agent, and discuss it with him. But do it now, before it's too late and your rig turns up missing.

. . .WA4LYL

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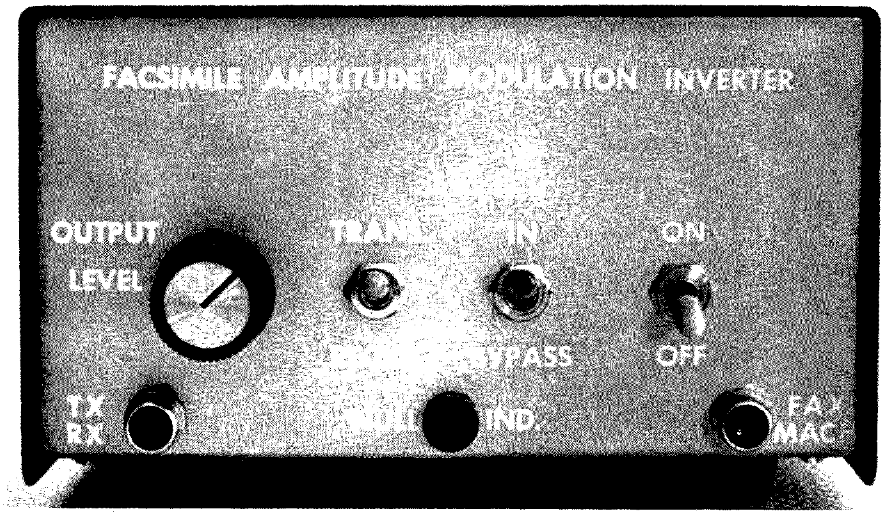


Michael R. Berge K7QXL
6019 So. 118th Place
Seattle WA 98178

Using the W.U. Desk Fax

Simple fax converter for ham use.

During the last few years Western Union has surplused hundreds of their Desk-facsimile machines, and ads for these machines have appeared in 73 Magazine and elsewhere. When properly converted, these inexpensive units produce excellent over the air pictures on the 6m and higher bands where they are legal to use.

Several modifications to the machine, which are necessary for radio transmission, were compiled by W7QCV from various sources and appeared in the May 1972 issue of *QST* (pp. 23-26).

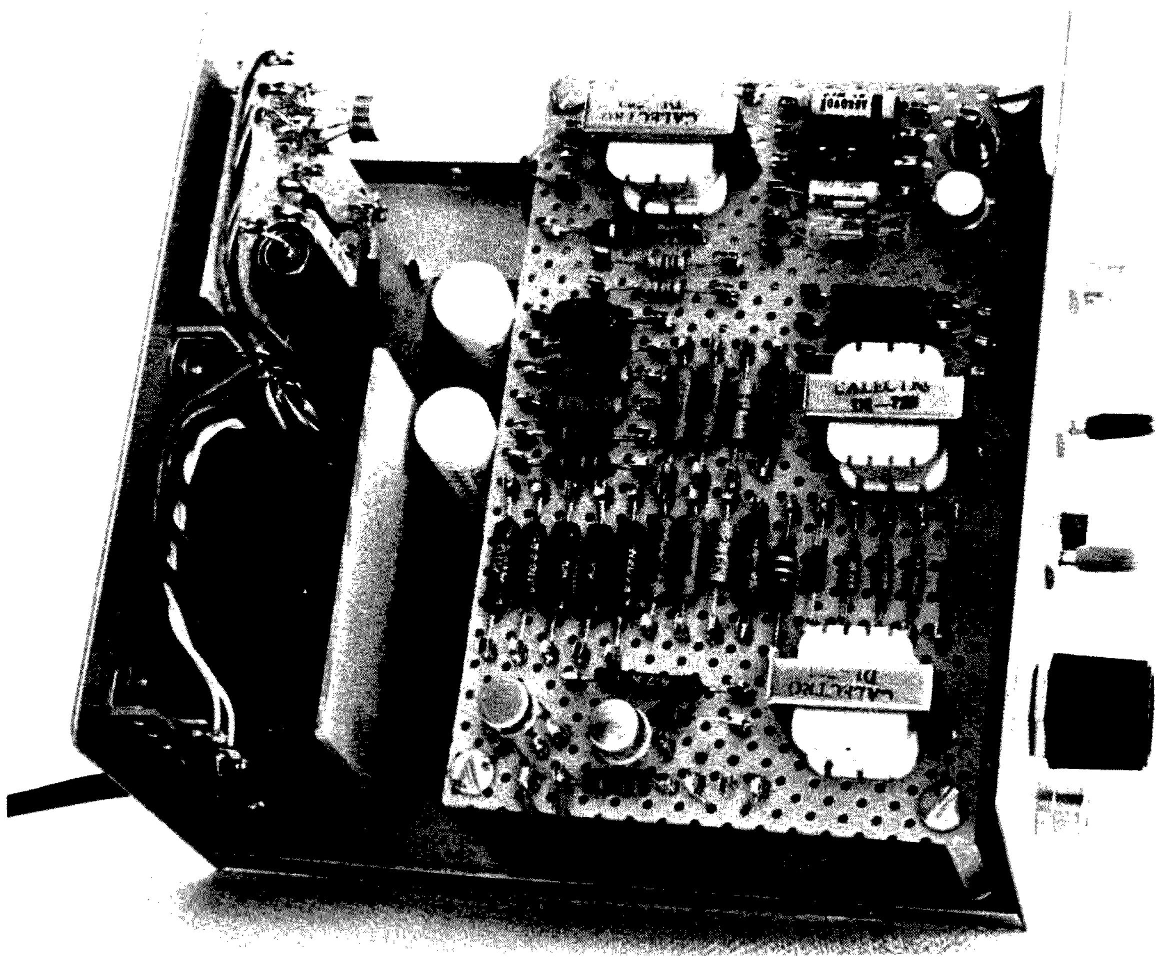
One of the most desirable modifications described in the above article is the use of a short length of plastic fiber optic light pipe to convert the negative picture produced by the machine into a positive picture. Unfortunately, proper adjustment of the light pipe can be very tricky and time consuming. The diameter of the light pipe, its distance away from the chopper wheel and the rigidity of its mounting system can greatly affect the 16dB null which is possible to squeeze out of the arrangement. If the null is not too good, background burning or diagonal lines may appear in the picture.

The difficulties with the light pipe prompted the development of a solid state modulation inverter that could simply be connected to the output of the machine. Another benefit of the converter is that it can take a negative picture off the air and change it into a positive picture.

Circuit Description

The modulated 2575Hz video carrier frequency from the Desk-Fax is fed into a forward-biased full-wave rectifier. The forward bias overcomes the diodes' barrier potential, enabling the diodes to start conducting at lower signal levels. Input versus output linearity is therefore enhanced. The output of the rectifier is fed through a simple RC filter into a T-notch filter to reduce the 5150Hz ripple component by approximately 60dB. The time constant of the overall rectifier-filter is such that the full resolution capability of the machine is preserved, an important consideration.

The detected video is then fed into U1, an op amp voltage summing circuit used as an inverter. A fixed negative voltage is applied to the inverting input of U1 along with the positive going video information.



Interior view of converter.

This results in a positive voltage at the output of U1 that swings toward 0V as the video input amplitude increases.

Output current from the inverter is used to operate the null indicator lamp circuit through driver transistor Q1. Inverter output is also fed through a 240K resistor and a silicon reverse voltage blocking diode to the balanced modulator, arranged as a current controlled attenuator. Output from U2, connected as a low distortion 2400Hz sine wave generator, is also applied through a T-pad to the balanced modulator. Modulator output voltage is amplified by U3.

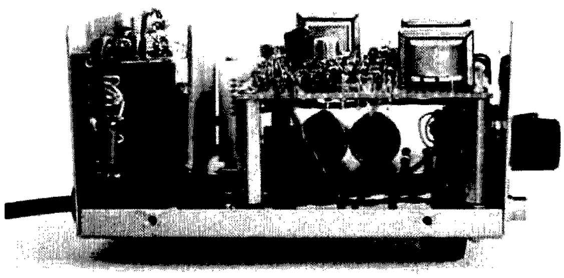
Although the video carrier frequency of the Desk-Fax is on 2575Hz, 2400Hz was chosen as the new carrier frequency. This new lower frequency can pass with little attenuation through the narrow audio bandwidth filters in some of the more modern pieces of equipment used on the VHF bands.

The power supply is conventional. The current requirements for the converter are +10V at 45mA and -10V at 10mA.

Construction and Adjustment

An audio oscillator and an oscilloscope should be used to adjust the null point of the T-notch filter and the frequency of the 2400Hz oscillator. The adjustment of the T-notch filter is critical, as the depth of null influences the purity of the carrier output waveform of the converter. Component tolerances in the T-notch filter should be tight. About 45dB of attenuation at 5150Hz should be easily obtained without adjustment but obtaining the desired 55dB to 60dB null may require a very slight change in the value of one or two components. Input and output leads of the T-notch filter should be disconnected from the rest of the converter circuitry during its adjustment.

The 2400Hz oscillator is easily put on frequency by changing slightly the value of



Side view of converter.

either one of its two frequency determining capacitors.

Adjust the 250Ω oscillator amplitude control pot for 2.7V rms on pin 6 of U2. With no signal input to the converter, +4.5V dc should be on pin 6 of U1, and a pure sine wave of about 0.75V rms should be on pin 6 of U3.

As shown in Fig. 2 and 3, increasing the amplitude of a 2575Hz sine wave signal applied to the converter input from 0V to about 1.2V rms will cause the 2400Hz carrier output of U3 to smoothly decrease to 0V while maintaining its waveform purity, and the null indicator lamp will extinguish.

The balanced modulator transformers are very susceptible to hum pickup from the power supply transformer. Connect the scope to the output of the converter with the sweep set at 20Hz and position the power transformer in the cabinet so that no ripple is seen superimposed on the 2400Hz carrier before bolting everything down. Also keep the completed converter one or two feet from the Desk-Fax, as the motors in it produce terrific magnetic fields.

Calectro D1-728 transformers were used for T1 through T 3 because they were found to have a very good electrical center tap. A 10V, 20mA lamp can be used in place of the LED and 330Ω resistor if desired. Don't try building the unit without the rf bypassing. Even a small amount of rf in the converter will kill the 2400Hz oscillator.

Make sure the stylus in the Desk-Fax will match the fine reproduction capability of

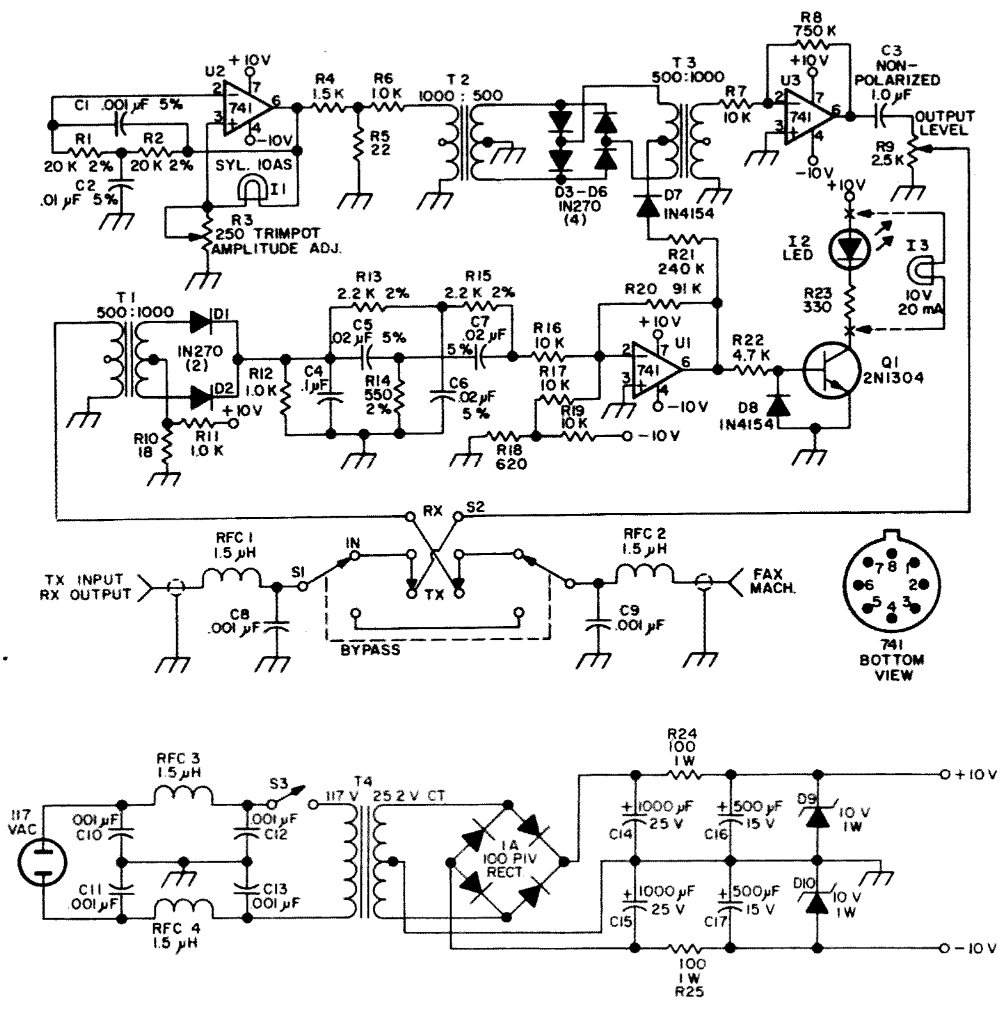


Fig. 1.

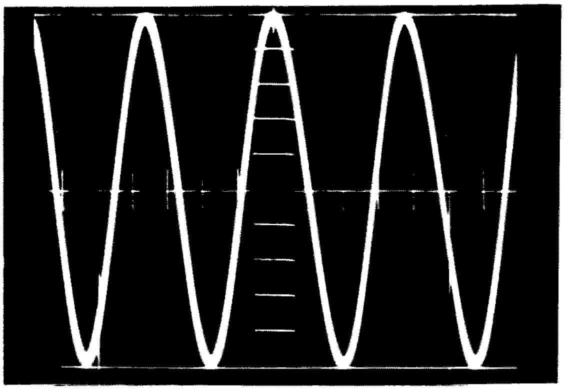


Fig. 3A.

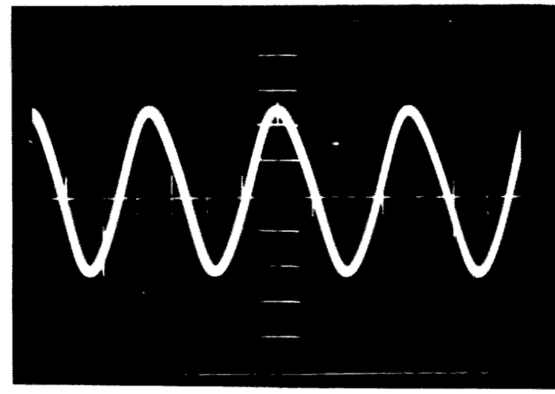


Fig. 3B.

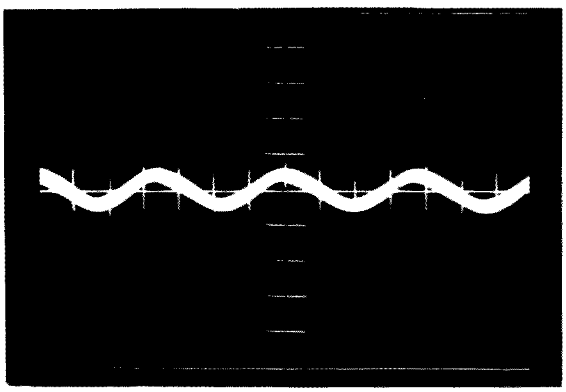


Fig. 3C.

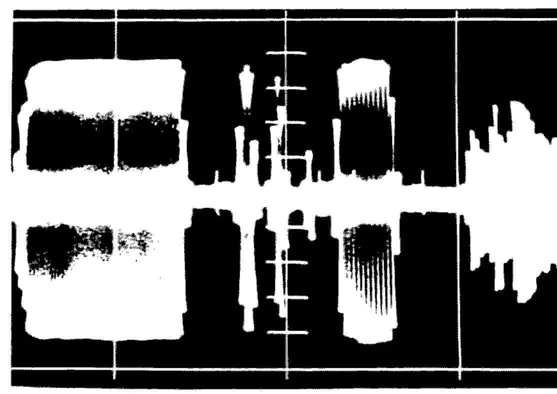


Fig. 3D.

As described in the text, photos A through C show that excellent waveform purity is maintained as the converter's 2400 Hz video carrier output falls toward OV with increasing 2575 Hz signal input. Photo D shows 2400 Hz carrier modulated by video information.

the unit. WA7LMO found that a length of .2mm diameter guitar wire, available from any music store, will yield hundreds of excellent long wearing styli.

Operation of the Converter

To use the converter for transmitting stop the drum of the fax machine, rotate the drum so the exciter lamp shines on the whitest area of the picture and simply adjust the machine's transmit gain pot (P2) until the null indicator lamp just extinguishes. If used for receiving a negative picture off the air, the signal should be fairly strong with no QSB. Adjust the receiver gain control so the null indicator lamp flickers vigorously, or during periods of uninterrupted tone the lamp just goes out.

Thanks go to WA7EHE for his rapidity in building a converter for his own station, which greatly aided critical over the air evaluation of the performance of the unit, and to WA7QQI for his photographic enlargements.

... K7QXL

PARTS LIST

All resistors 1/2 watt, 5% carbon unless otherwise indicated.

R1, R2 20,000Ω, 2% film
R3 250Ω, trimmer potentiometer
R4 1500Ω
R5 22Ω
R6, R11, R12 1000Ω
R7, R16, R17, R19 s 10,000Ω
R8 750,000Ω
R9 2500Ω, linear-taper potentiometer

Cont.

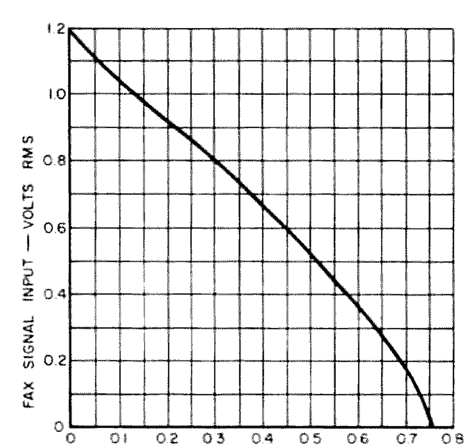


Fig. 2. Converter input-output linearity.

K7QXL Parts List continued.

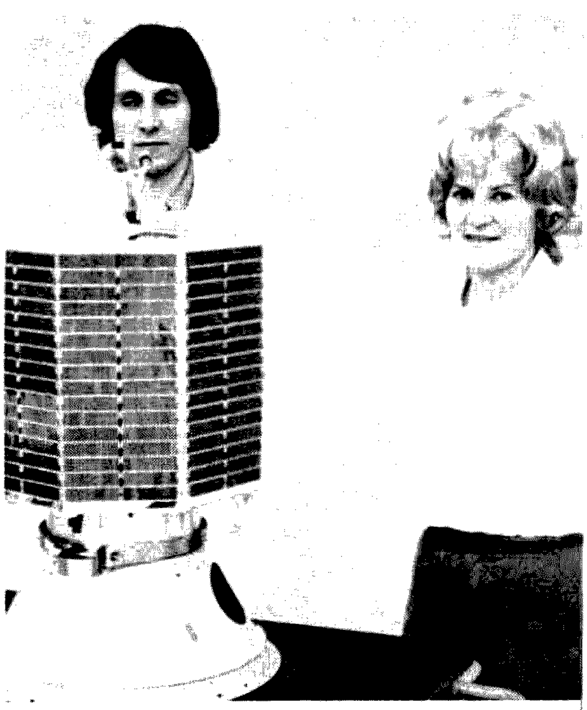
R10 18Ω
R13, R15 2200Ω, 2% film (two 1100Ω, 2% resistors in series)
R14 550Ω, 2% film (220Ω, 2% in series with 330Ω, 2% resistor)
R18 620Ω
R20 91,000Ω
R21 240,000Ω
R22 4700Ω
R23 330Ω
R24, R25 s 100Ω, 1 watt
C1 .001 μF, 5% polystyrene (Mallory SX210)
C2 .01 μF, 5% polystyrene (Mallory SX110)
C3 1.0 μF, 50 volt paper, non-polarized
C4 .1 μF, mylar
C5, C6, C7 .02 μF, 5% polystyrene (two mallory SX110 .01 μF, 5% capacitors in parallel)
C8, C9, C10, C11, C12, C13 .001 μF, 1000V disc ceramic
C14, C15 1000 μF, 25V electrolytic
C16, C17 500 uF, 15V electrolytic c
D1, D2, D3, D4, D5, D6 1N270 germanium diode (do not substitute)
D7, D8 1N4154 silicon signal diode (or equiv.)
D9, D10 10V,s 1 watt, 5% Zener diode (1N4740A)
LED Light-emitting diode, 1500 fL. (Radio Shack 276-026)
I1 10V, 10-14mA lamp (Sylvania 10AS or equiv.)
I2 10V, 20mA pilot lamp (if LED and R23 are not used)
Q1 2N1304 NPN germanium switching transistor (Radio Shack 276-2001)
RECT. 100 PIV, 1 Amp, full-wave bridge rectifier (Motorola MDA920-3)
RFC1, RFC2, RFC3, RFC4 1.5 μH choke (or 3 ferrite beads)
S1, S2 DPDT miniature toggle switch
S3 SPST miniature toggle switch
T1, T2, T3 500Ω ct to 1000Ω ct miniature transistor driver transformer (Calectro D1-728 recommended)
T4 117V primary, 25.2V ct secondary power transformer
U1, U2, U3 741 operational amplifier
Cabinet 13.34cm X 7.62cm X14.92cm(Radio Shack 270-253)

Ralph E. Taggart WB8DQT
4515 Oakwood Drive
Okemos MI 48864

How to find the Satellite

Be it Oscar 7, Oscar 6, or the weather satellites . . .

With the current interest in OSCAR communications satellites as well as the various weather satellites, today's amateur often faces the need for reliable information on the subject of satellite tracking. Although a precise mathematical treatment of the subject could quickly drive most of us out of business, there are a number of quite simple approaches that can be used by amateurs to produce reliable tracking data. Much of the simplification is achieved because amateur antennas in the VHF region are not terribly sharp so that a pointing error of a few degrees is not likely to produce any noticeable effect on either a received or transmitted signal. Very little equipment is required. A world globe is necessary for generating aiming information for the various geosyncronous satellites while some polar coordinate graph paper, some clear acetate plastic sheets, and a compass for drawing circles will be adequate for the near polar orbits of the OSCAR repeaters and the ESSA and NOAA weather satellites.



Jan King W3GEY AMSAT-OSCAR-B Project Manager and Marie Marr, AMSAT'S Aerospace Technician, with the spacecraft.

Before getting into the details of tracking it is worthwhile to devote a little space to the subject of satellite orbits in general. Any body in orbit, be it natural or artificial, traces a path in space around the body it is orbiting. In the case of an artificial satellite, the nature of the orbit depends upon the speed and direction of the satellite when it is "injected" into its orbit by the rocket booster. Once established, the nature of the orbit is fixed and remains virtually unchanged. An orbit is effected by the almost immeasurable drag of residual atmosphere at the orbital altitude or by the gravitational forces of the sun and moon, but these forces are not large enough to exert any really perceptable change within the operational lifetime of a satellite. An orbit has two principal parameters, the altitude of the orbital path above the earth's surface and the inclination of the orbit to the earth's equator. The altitude of the satellite is usually expressed by noting the *apogee* or high point in the orbit and its *perigee* or low

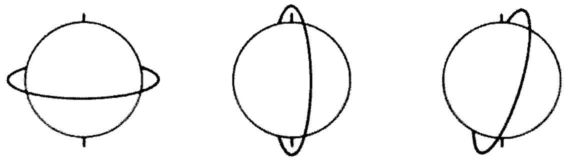


Fig. 1. Representative orbital paths with varying inclinations. A shows an equatorial orbit (inclination 0°) in which the path of the satellite is over the equator at all times. B shows a polar orbit (inclination = 90°) where the satellite crosses both poles on each revolution and crosses the equator at an angle of 90°. C shows a near polar orbit characteristic of NOAA, ESSA, and OSCAR satellites.

Antenna Elevation (°)	Great Circle Arc Distance Statute Miles	Kilometers
90	0	0
80	550	890
70	1170	1880
60	1800	2880
50	2420	3880
40	3040	4880
30	3660	5880
20	4280	6880
10	4900	7880
0	5520	8880

TABLE 1. Antenna elevation angle for geosynchronous satellites as a function of great circle distance from the receiving station to the satellite sub-point.

point. Virtually all of the orbits we will be concerned with will be circular or nearly so (apogee = perigee) and we will treat the mechanics of the orbit as if the orbit were precisely circular. This is a far cry from the early days of the space program where it was sufficient just to get a satellite into orbit, even one with widely differing apogee and perigee values.

Fig. 1 shows several extremes in orbital inclinations. Fig. 1A shows an equatorial orbit (inclination 0°) where the orbital path lies above the equator at all times. 1B shows a polar orbit (inclination 90°) where the satellite passes over the poles during every revolution, crossing the equator at an inclination of 90°. The orbits of OSCAR and weather satellites are nearly polar, coming within 10° of the poles on each orbit.

The position of the satellite at any time is a function of its position along its orbital track and the position of the earth beneath it. When referring to satellite position we will be talking about the satellite *sub-point*, that portion of the earth directly under the satellite at any particular time. The period of the satellite in its orbit (the time required for one revolution of the earth) is directly proportional to its orbital altitude. A weather satellite at an altitude of 800 nautical miles may require 115 minutes to complete an orbit, while the moon, our natural satellite, at an altitude of 240,000 miles requires some 28 days to complete one revolution of the earth. The motion of the satellite in its orbit and the revolution of the earth beneath the satellite (360°/day or 15°/hour) are completely independent so both factors must be taken into consideration in determining the satellite sub-point.

Geosyncronous Satellites

The orbits of the various geosyncronous satellites are the most elegant orbits but the easiest to visualize and use. Such satellites have equatorial orbits and are located at an altitude of slightly more than 22,000 statute miles. At that altitude an orbital period is precisely 24 hours (1440 minutes). Since the direction of the movement of the satellite in its orbit is the same as the direction of rotation of the earth, the satellite maintains the same position over the equator at all times. Since the position of the satellite with respect to the earth does not change (hence the term geosyncronous), the position of the satellite in the sky when viewed from the earth is also constant. Reception of such satellites is merely a matter of determining the proper antenna bearing and elevation. Once achieved, antenna alignment need not be altered unless the satellite is purposely moved to another position using an internal reaction system. Such geosyncronous satellites are ideal for communications use since antenna bearings need not be changed. Unfortunately, no amateur geosyncronous communications satellites are in our immediate future. The ATS satellites (135.6 MHz) and the SMS/GOES satellites (1691 MHz) do transmit weather pictures and other facsimile data and are thus of interest to weather satellite enthusiasts. In addition to WEFAX relay, the ATS satellites (ATS-1 and ATS-3) are used as experimental repeaters giving

hemisphere wide radio coverage with all the convenience of full quieting FM. A few evenings spent listening to round tables from one side of the Pacific to another will make the local repeater look like small potatoes! A world globe and the data in Table 1 are all you need to compute your proper antenna orientation. The following data show the position (over the equator) of the three geosyncronous satellites of likely interest to amateurs:

ATS-1	149°W
ATS-3	70°W
SMS-1	75°W

Mark your own location on the globe and the position of the satellite(s) of interest to you. Using a piece of string or the edge of a piece of paper, mark the great circle distance (shortest distance measured on the surface of the globe) between your station and the satellites you wish to receive. The direction of the great circle arc represents your desired antenna bearing. Using the globe mileage scale as a guide, note the great circle distance and refer to Table 1 to interpolate the antenna elevation. The examples in Table 1A show ATS-1 and 3 antenna aiming data for two station locations as an example. Check them out on your globe and then try your own.

In this case, a station in Lansing, Michigan could receive signals from both satellites since they are both above the local horizon. Antenna bearing and elevation would have to be changed, however, in switching from one to the other. The hypothetical Fairbanks station would have ATS-1 above the local horizon and would be in business there, but that station would be out of luck with ATS-3, which would be below the horizon to the SE. Generally speaking, if the great circle distance between the satellite subpoint on the equator and the potential receiving station is greater than 5500 statute miles (8900 km) the satellite will be below the horizon and will not be usable. Generally, in

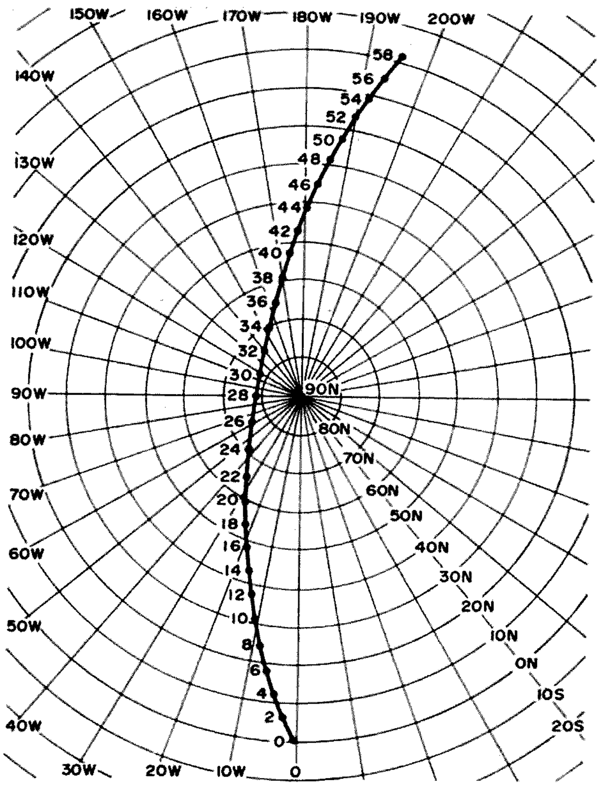


Fig. 2. Sample satellite track plotted from data in Table 2.

order to maintain full quieting signals the antenna elevation should be 5° or better. Some stations in western Europe will just be able to receive ATS-3. The US plans to place another SMS satellite over the eastern Pacific while the USSR has plans for a similar satellite over the Indian Ocean and Japan will place another over the Western Pacific. For those interested in constructing suitable S band converters, the next few years should provide stations in any part of the world, aside from the highest polar latitudes, with reception potential from at least one of the SMS style meteorological satellites.

Tracking Polar Orbiting Satellites

The first step is to plot a reference orbital track. Take a piece of the polar coordinate paper. Such a piece of graph paper can be used as a polar map projection and we will use it as such in describing the tracking procedure. With the graph paper in its normal orientation you will note that the

TABLE 1A

Satellite	Station Location	Antenna Bearing	Distance	Antenna Elevation
ATS-1	Lansing, Mich.	SW	4600 mi.	15°
ATS-3	Lansing, Mich.	SSE	2900 mi.	42°
ATS-1	Fairbanks, Ak.	S	4500 mi.	17°
ATS-3	Fairbanks, Ak.	SE	5900 mi.	----

radial lines on the paper correspond to increments of longitude in a polar projection and the concentric circles can represent increments of latitude. If the 0° line (facing upward) is arbitrarily chosen to represent 0° of longitude, you can trace around the paper in a clockwise direction noting the calibration of the lines in ° West longitude. In a similar fashion, if the center of the paper is chosen to represent 90°N latitude (the north pole), successive concentric circles can be labeled as 80, 70, 60, 50, 40, 30, 20, 10 and finally 0° latitude (the equator). Turn the paper around so that 0° faces downward toward you and label the graph paper as shown in Fig. 2. These coordinates will be used to plot a reference orbital track. Once the labeling is completed, consult Table 2 which shows the satellite sub-point plotted

Minutes After Equatorial Crossing	Latitude (°N)	Longitude (°W)
0	0	0
2	6	2
4	12	3.5
6	18	5.5
8	24	8
10	30.5	10
12	37	13
14	42.5	15
16	49	18.5
18	54	22
20	60	27
22	65	32
24	71	44
26	76	62
28	78	86
30	78	115
32	75	140
34	70	154
36	65	164
38	59	170
40	53	174
42	47	178
44	41	181
46	35	183.5
48	28	186
50	22.5	188
52	16	190
54	11	192
56	5	193.5
58	-2	195.5

TABLE 2. Data for plotting the reference orbital track with intervals of 2 minutes. The track should be plotted on a piece of polar coordinate graph paper and then transferred to a clear acetate sheet.

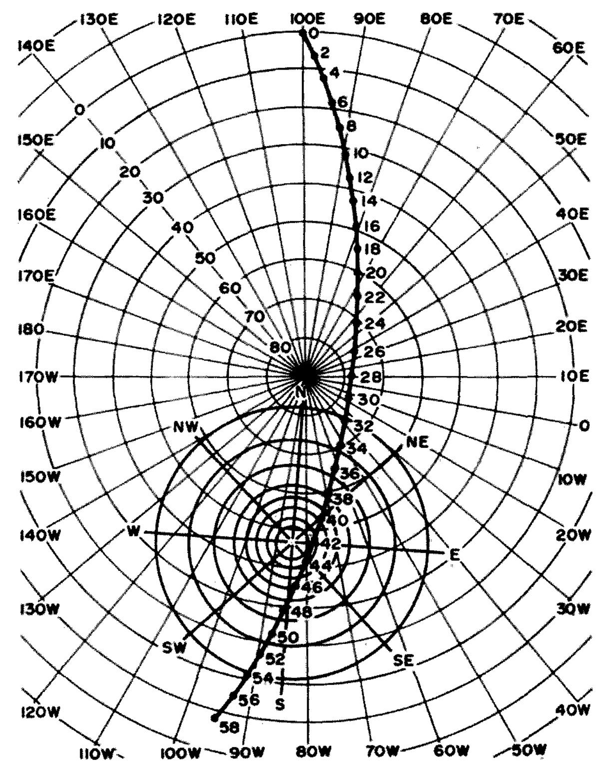


Fig. 3. Station location (46°N, 85°W), antenna elevation circles, and antenna bearing lines with a superimposed orbital plot.

at two minute intervals following an equatorial crossing. Using a pencil and consulting the graph calibrations, transfer the sub-point data in Table 2 to the graph. You should get a plot essentially identical to that of Fig. 2. When you are sure that all the data points are accurately placed, ink in the 2 minute points and the connecting track. Place a piece of clear acetate plastic over the sample plot and transfer the points and the track to the clear plastic sheet. Some small felt tip pens will work well for this step as will india ink. The ink should be indelible to prevent smearing. Before removing the plastic, mark the position of the graph center point. Put the acetate sheet aside until we are ready for a sample tracking exercise.

The next step is to prepare a "map" that will enable you to convert satellite position data to bearing and elevation figures for your antenna. If we view the polar coordinate paper as a map, the calibration of the paper is rather inconvenient for stations in the United States, primarily because US locations would fall on one side of the paper where the latitude circles do not extend all

the way to the equator. Examine your trusty globe and determine the nearest 10° increment of longitude to your location. In my case, since my QTH is located near 85°W, I chose 80° as the nearest point. Taking another piece of the polar coordinate paper, arbitrarily label the radial line directly facing downward with this value. Although my example is 80°W (used in the following example) yours is likely to be some other value. With that reference line established, label the remaining 10° increments of latitude from 0-180°W and from 0-180°E. The concentric circles of latitude are labeled the same way they were in Fig. 2. When you are finished you should have a layout similar to that of Fig. 3 except that it is "customized" for your location. Next, locate your position on this "map" and place a point there. This has been done for Fig. 3 (again, my location). Once your QTH has been located, the next step is to add a plot that can be converted to antenna elevation angle. The required antenna elevation angle for any given satellite is a function of the distance of the satellite sub-point and the altitude of the satellite in its orbit. Since the altitudes of the weather satellites and OSCAR satellites all cluster near 800 nautical miles because of the desired orbital geometry for weather satellite service, it is possible to calculate distances from the receiving stations that represent various antenna elevation angles. These data are summarized in Table 3 for an orbital altitude of 800 nautical miles. The distance here is plotted in degrees since this can be determined directly from the polar

Antenna Elevation Angle (°)	Great Circle Arc Distance (°)
90	0
80	2
70	4
60	6
50	8.5
40	11.5
30	15.5
20	20
10	27
0	36

TABLE 3. Antenna elevation angle as a function of great circle arc distance for a satellite in an 800 nautical mile orbit.

coordinates on the paper. Take a compass and with the point on the center of the paper (the pole), adjust it so the pencil point rests 36° out from the center. Transfer the point of the compass to the spot representing your QTH and use the compass to inscribe a circle with a radius of 36°. This circle represents the maximum satellite subpoint distance you could expect reception since it is equivalent to an antenna elevation of 0°. Using the data in Table 3 repeat the process with a series of smaller concentric circles. Fig. 3 shows circles representing 0, 10, 20, 30, 40, 50, 60 and 70° of antenna elevation. You can draw a circle for 80° if you wish, but it is quite small. At an antenna elevation of 90° the antenna is pointing straight up so the center point represents this elevation, which you will only use when the satellite passes directly overhead.

The only thing that needs to be added to our map now is a series of lines to indicate antenna bearing or direction. Using a straight edge, draw a line from the pole, through your QTH and out the bottom of the largest (0°) circle. This is our north-south reference line. A line at right angles to this and passing through your QTH will be the east-west line. Two additional lines, each passing through the center, can be added for NE-SW and SE-NW. Your completed map should resemble that of Fig. 3 except that everything would be centered on your QTH. In addition to preparing your own map, you might wish to duplicate the one in Fig. 3 so you can follow the tracking example. For the purpose of Fig. 3 I located my QTH at 46°N and 85°W with 80°W representing the lower center radius.

Believe it or not we are now ready to use all of this "stuff" in an actual tracking exercise. The source for our data will be the satellite equatorial crossing data broadcast by W1AW. The W1AW bulletins include satellite crossings for both operational weather satellites and OSCAR satellites. Let's take a typical example. W1AW announces that NOAA 3 will cross the equator at 1500Z at 100°E. The equatorial crossings are always northbound — ie., the satellite leaves the southern hemisphere and enters the northern hemisphere — and our tracking times will be referenced to this

time. Take your map (for the sake of this discussion use the one you made that duplicates Fig. 3) and place the clear acetate sheet with our sample track over the map. Place a thumbtack through the center of the sheet *and* the center of the polar map. You should now be able to rotate the transparent overlay with the track about the center of the map. Rotate the acetate overlay until the 0 minute time point of the sample track is located on the equator at 100°E and you should have something that corresponds exactly to Fig. 3. You now have laying before you a complete representation of where the satellite is going to be in the first half of its orbit. Note that the satellite will progress steadily northward after its equatorial crossing and will pass east of the North Pole at approximately 28 minutes after its crossing time (1528Z). Also note that the earliest time that the satellite will pass within the 0° antenna elevation circle is approximately 32 minutes after equatorial crossing (1532Z).

There is no point in listening for the satellite before 1532Z for it will be below my horizon. Using the reference track as a guide, plot the direction and antenna elevation for each of the two minute positions during which the satellite is within range. You should get something like the data in Table 4. Note that the satellite will only be within range from 1532 until 1554Z. If you were to move the antenna to the positions indicated at the proper times you would – wonder of wonders! – be tracking the little devil.

Time After Equatorial Crossing (min.)	Time G.M.T.	Antenna Elevation (°)	Antenna Bearing
32	1532	0	NNE
34	1534	8	NNE
36	1536	17	NNE
38	1538	28	NE
40	1540	46	NE
42	1542	60	E
44	1544	60	SE
46	1546	41	S
48	1548	24	S
50	1550	14	S
52	1552	7	SSE

TABLE 4. Example of antenna tracking data for a satellite equatorial crossing at 1500Z at 100°E from the quthors QTH. The plot in Fig. 3 was used to derive this data.

Although the W1AW bulletins give at least three crossings for any given day, with any single crossing the crossings for the rest of the day can be determined if you know the orbital period of the satellite. Successive equatorial crossing times will be separated by the orbital period. Successive equatorial crossing locations will move westward along the equator due to the rotation of the earth beneath the satellite. The earth rotates 15° every 60 minutes (360° in 24 hours) or 0.25° per minute. Thus, 0.25° x the satellite orbital period in minutes will tell you how much further west the satellite will cross the equator the next time it arrives. In the case of NOAA 3, whose orbital period is 116.2 minutes, the next equatorial crossing would occur at 1656Z (1500 + 116 min.) at 71°W (116.2 x 0.25° = 29° which subtracted from 100°E gives 71°E). Table 5 shows representative crossing times and locations for the entire day derived from the single piece of data presented in the bulletin transmission.

If you use the Fig. 3 map, the orbital overlay, and the sample data in Table 5 you will be able to see how the day's passes relate to my station. The pass before the reference example (129°E) would cause the satellite to be above the horizon to the east but results would probably not be outstanding since it would barely reach 10° elevation. The reference pass has already been discussed. The pass after the reference pass would cause the satellite to come over to the northwest of the station and since it would get as high as 28° it would be easily received. The next pass (42°E) would be off to the north and quite low in the sky. Although the satellite might be audible throughout the afternoon as it just cuts the receiving circle (0° elevation) to the north, the next good pass would be at 1941 EST when the satellite crosses the equator at 45°W. Note that these evening passes, in contrast to those of the morning, are characterized the satellite moving from south to north. The satellite would first be audible approximately 8 minutes after the 1941 EST crossing and would drop out at approximately 27.5 minutes after the crossing. The 2137 EST pass at 74°W would be an excellent one while the next one (2233.4 EST 103°W) would be marginal. Once you feel you

understand the use of the map and overlay, use your own map with the overlay and calculate tracking data for your own station using the crossing data in Table 5. When you can do this you are ready to take W1AW data for any satellite and generate tracking information. The reference track was made up on the basis of a 116 minute orbit and can be used with any of the operational weather satellites (ESSA8, NOAA 2, NOAA 3, etc.) as well as the OSCAR satellites that are launched "piggy back" with NOAA/ ITOS launches. Should an OSCAR satellite or a weather satellite package be launched that by mischance departs greatly from this track we can include a table in a future issue of 73 to permit you to make up a reference track to fit its orbital path as well as any other supplimentary data you might need.

Just a few final notes are in order. Reception from a satellite is only possible when the satellite is above your local horizon – that is, within the 0° elevation circle on your own local tracking map. Given clutter on the horizon, good results are usually obtainable only when the satellite is at least 5° above the horizon. DX work through an OSCAR satellite demands that the satellite be above the horizon at both stations. This occurs quite frequently within

Crossing Time (E.S.T.)	Crossing Latitude
0019.0	115W
0215.2	144W
0411.4	173W
0607.6	158E
0803.8	129E
*1000.0	100E
1156.2	71E
1352.4	42E
1548.6	13E
1744.8	16W
1941.0	45W
2137.2	74W
2233.4	103W

TABLE 5. Equatorial crossing data for a single day calculated from the reference crossing of 1500Z at 100°E. The crossing time was converted to EST and preceeding and succeeding crossings were calculated on the basis of a 116.2 minute (1 hour 56.2 minute) orbital period for NOAA 3. With this orbital period the location of successive crossings will move westward 29° per orbit. The reference crossing data are marked with an asterisk.

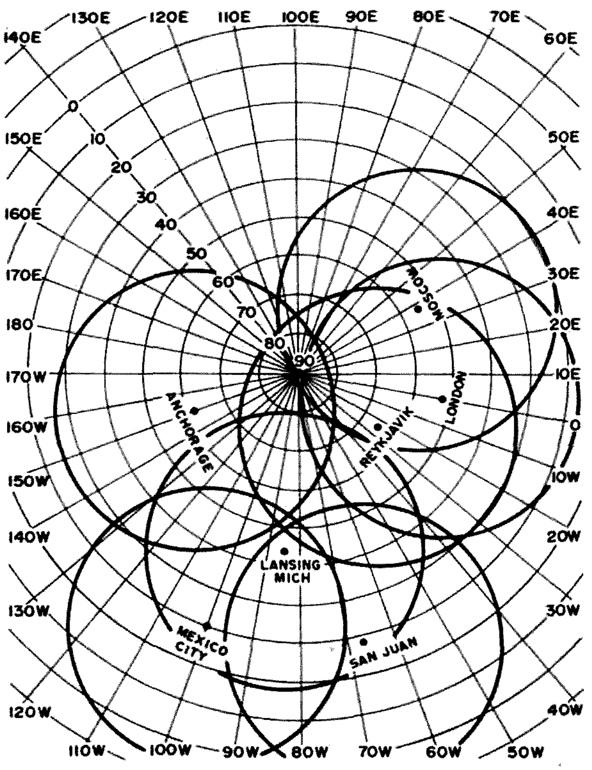


Fig. 4. Polar projection with the author's QTH and several DX cities marked. Each location has a circle around it representing the distance corresponding to a 0° antenna elevation angle. Two requirements must be met for communication between any two points using a satellite repeater. First the zero elevation circles around the two points must overlap or communication is not possible. The greater the overlap the more opportunities there will be for a successful contact. Secondly, both stations must utilize a satellite pass that intersects the area of overlap between the two stations for it is only when the satellite sub-point is within the zone of overlap that it is above the horizon at both stations simultaneously. A little work with the orbital overlay will indicate what passes (in terms of equatorial crossing point) may be used and how long the satellite would be in the "overlap" zone. Since these circles represent zero elevation angle they are somewhat optimistic. Intersection of 5° circles would be more conservative but the zero elevation circles can be used with foresight and planning for specific contacts.

the US and Canada but real long haul DX requires some planning. Fig. 4 is a duplicate of my tracking map but on this copy I have drawn in the maximum "reception circles" (0° elevation angles) for a number of cities in various DX localities. Only those locations with circles that intersect my own can be expected to produce satellite contacts through an OSCAR package. The greater the degree of overlap, the higher the satellite will

be at both my location and that of the DX station and the longer the time available to establish a contact. Note that the circles around such widely separated points as Mexico City, San Juan, Anchorage, and Reykjavik comfortably overlap the acquisition circle around my own QTH and thus offer ready opportunity for communication between these points. The outer part of the circle around London intersects my own but this one would be tight. It would probably be best to calculate a specific pass where the satellite would intersect the area of overlap and arrange a schedule with an active London station. At best there would be a few minutes where communication was possible. The Moscow circle barely touches my own so communication with a station there would probably not be possible without a carefully arranged schedule, a little tropo bending, and some fast CW. The preparation of such a map would provide you with a realistic assessment of your OSCAR DX capabilities from your own QTH. Generally speaking, you should look for areas where the satellite is at least 10° high in both your own "sky" and that of the DX station – this is not only provides a realistic path but assures that ample time exists for a QSO. Where large overlap exists you can probably count on running into stations with random operating but as the overlap narrows you should consider schedules during specific passes if you are really serious about accumulating countries.

The information presented here should permit virtually any amateur to handle the task of satellite tracking. Should satellites be launched that do not fit the materials described here, 73 will provide updated materials as required. Although we have nicely sidestepped many aspects of spherical geometry and trig with a number of simplifying assumptions that would make a mathematical purist writhe in agony, the tracking procedure described here has one feature that transcends all those petty considerations – it works! You will get your antenna pointed in the right general direction at the right time which certainly beats swinging madly around trying to figure out where the satellite is and where its going next.

. . .WB8DOT

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RTTY SECRETS UNVEILED

A recent "Junk Box TU" was constructed to provide a dependable unit expense. The basic unit makes use of tube type components in a configuration dictated by parts available in the junk box as the sole limitation. Using the "if ya have 'em use em" philosophy can be a real challenge in overcoming basic engineering problems. Several notes and surprises resulted from experimentation. To others of like inclination who feel that those beautiful military components may never be used, some experimental notes are presented.

Relay Driver

It was found that a high voltage (not too high) transformer with full wave rectification would work very nicely in the HOFF Mainline Keying System, as shown in Fig. 1. The ±45V is established across the 50K linear pot. Higher voltages will require a larger value pot – experimentation achieves proper balance at the correct diode voltage.

6AL5 Detectors

Many of the older (and cheaper) TU designs call for a 6AL5 detector. Usually low output or imbalance problems result when using this type of detector to trigger an Eccles Jordan Bistable Vibrator. Switching to diodes in a doubler circuit gives outstanding results and reduces space and power requirements, see Fig. 2. One further advantage is that by grounding either point A or B and placing a small positive bias voltage to points A' or B' (equal to the diode dc output) "mark only" or "space only" copy is possible.

Scope

Sure you like to see the cross pattern but 2API's, 902A's and like tubes are not as easily obtained anymore. There is, however, the mysterious 3API (which is anything *but*

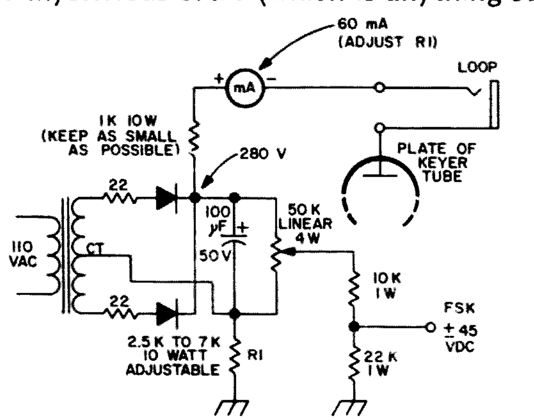

Fig. 1. Relay driver.

a three inch version of the 2API) still around in large quantities for a very small price. This CRT is rather long and skinny but works

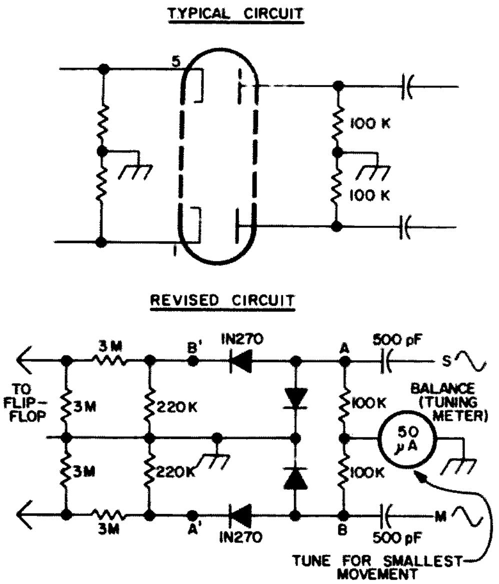

Fig. 2. The top circuit shows the use of a 6AL5 detector. The revised circuit on the bottom uses diodes to accomplish the same purpose.

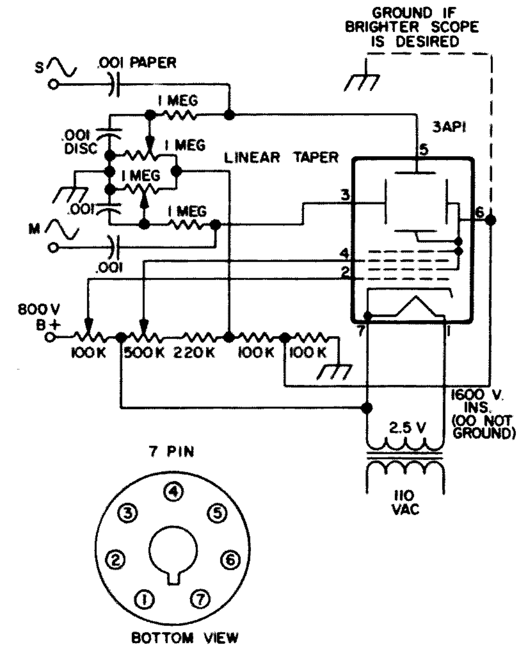

Fig. 4. The scope circuit using the inexpensive 3API.

very well with a few differences in scope design. The main difference is the filament supply which is 2.5VAC at 2.1. Transformers supplying this voltage are quite inexpensive if purchased new, and the center tap of a 6.3VAC supply can be pressed into service quite easily from the junk box to supply a slightly higher 3.1VAC for the 3API filament, as shown in Fig. 3. This higher voltage won't promote long life, but I've been using the same tube for over a year with no apparent weakening of emmission. The schematic in Fig. 4, shows the major values for the use of this tube and the pin connections and base diagram.

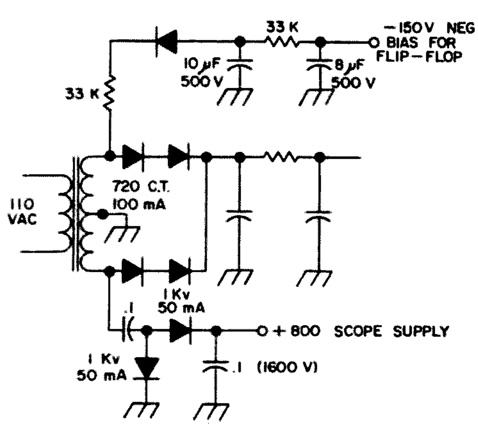

Fig. 3. CRT power supply.

No special shields are required if relative care is given to CRT positioning vs. stray magnetic fields.

Scope Driver

Many RATT monitors make use of a scope driver, some with additional tuned circuits to "shapen up" the cross pattern. There are some who prefer blinking neons, others like wiggle needles, but I prefer the cross pattern because of a drifty receiver and I like to observe the level of QRN and QSB. After a time, one quickly learns if an S-3 RTTY QSO is "worth the paper" or whether or not power lines (close by) will destroy copy because of exceptionally high noise levels. The scope shows this quite well if it's not too sharp. Ideal patterns are of course the familiar cross. But more information can be evaluated if the band pass is slightly broad, see Fig. 5.

Most terminal units do not require sharply tuned coils because shifts vary and comparators can trigger sharply. Scope displays, however, show the composite signal, amplitude variation (by degree of deflection) and selectivity (the "off" tone "spills" into the displayed tone filter causing the line to spread into an elipse). One problem encountered, however, was the "lopped cross" or a cross that looked more like an "X." This was traced to a common cathode resistor in the scope driver circuits previously published. Separate them and the cross returns.

Fig. 5. Scope patterns.

Another tip to the wise is wiring the scope B+ to the extra contacts on an auto-start relay. This cuts the "dot" during standby, and prevents premature phosphor burn. More sophisticated circuits can of course lower anode voltage (to a dimmer setting) in the absence of a signal.

Transceiver Notes

RATT need not be so difficult especially in transceivers. In fact in some cases it's much simpler. In my transceiver, an old SR-160, only one FSK keyer is required. On 20m (USB only) the received upper side band appears as a preversed signal to the TU (but not on the air!). Because the i-f is common to 80, 40, and 20m, shifting takes place on the 5.2 MHz common oscillator. This guarantees that once set, the shift holds on all bands. When no voltage appears on the diode it still conducts slightly because of rf rectification thus lowering the frequency. Therefore, a holding bias provided in the Hoff circuit keeps everything steady. On receive, however, the diode bias must be *disconnected* or *permanently* applied to keep the receiver VFO (common to both transmitter and receiver) from shifting the receive frequency. Experiments with shift pot and polar relays, seriously compound the wiring problems and really are not worth the effort.

Tuning Standards

Tuning toroids is easy if you follow the many procedures and outlines available in current publications, but for the casual RTTY buff, the tuning fork serves and saves money. Tuning forks are available from Federal Signal Co., at $5 a piece and may be used with a crystal calibrator/BFO combination in the receiver. So, don't rush out and buy a counter and an af generator to tune toroids.

Power Output

A very good fan can increase the duty cycle of a transceiver rated for peak service on instantaneous voice.

Most modern transceivers can not handle continuous loads for a great length of time. The sweep tube amplifier runs hot and thus forced air cooling increases the duty cycle. I have been operating RTTY at 90 watts input (rated 125 watts) with two 12DQ6s, for over a year with average key down times of 12 minutes on, 12 minutes off with no sign of soft tubes. SWR and antenna loading must be good, of course. In many cases the power output meter may not peak right at the plate current dip (in all parts of the band) but tuning up at the dip is the best procedure and provides the coolest operation. Neutralization adjustments on transceivers are a band compromise and should be set to the RTTY portions of the band.

Many of these notes will appear distasteful to the more discriminating RTTY enthusiast of the MLTT/L2, ST-6, and the WC1 variety. But for some, (and I've seen 'em) it's the best we can do under the circumstances. RTTY is really not so complicated once the basics are understood, and fiddling around with a home brew device often allows new concepts to be explored in detail. If you haven't joined the crowd yet, give it a whirl. And do it from the junk box until you learn the basics.

. . . W3JJU

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Miniboxing The 432er Receiver

The breadboard models of the 432'er work fine, the circuit is completed and sounds great on the air, components have been selected or fabricated, so it is now just a question of how small can the miniboxes be to package the whole job, what units to include in each box, and ease of construction by the homebrewer. Good flexibility and growth possibility should be retained, but this doesn't mean a box for every stage.

Figure 1 shows the block diagram of the third converter and the 135 kHz i-f strip. You could combine the 1.65 MHz i-f with the 135 kHz strip but as an experimenter I like to have a broadband i-f and diode on hand for all rf and antenna work. Because, as you will see when you operate one, even a good crystal local oscillator working in the UHF region will get thrown out of the narrow passband of the i-f with small changes in the mixer and rf stages.

Perhaps the 1.65 MHz section could be included in the tunable 28–30 MHz enclosure. We'll see. In the meantime let's tackle the last converter and 135 kHz i-f strip, which has the biggest components of the receiver.

Those very small Japanese units have an outside-threaded cup core that turns down over the i-f winding, which is on a separate tiny piece of powdered iron core. I think they are too small for practical work by the average amateur builder. The cores and windings used here seem to me about the limit on small size for now, with number 38 wire in them. The cup cores of old Miller number 10C i-f transformers originally made for tubes work almost like magic. The use of *two* sides of a single copper-clad board to fit things into a small minibox has worked out well. This makes for two layers of circuitry, but both are available from the outside of the minibox. Repairs or changes can be made easily, and you can also take it right out of the box with little work. See details below.

The average component density works out at about four stages in a 2 x 1½ in. box at present. So without jamming things too tightly and making construction difficult, each transistor and its associated components should fit into a space 2 x 1½ x ¾ in. And they do, as you will see.

While this model of the 432'er will not go into a camera case, it does look as though the old familiar pre-war transceiver case 12 in. high will hold everything nicely, including the battery.

Because it is really important that you know what you are undertaking with this kind of work, I will quote from the RCA "Transistor, Thyristor, and Diode Manual," page 582: "Circuits which work at UHF demand more than ordinary skill and experience in construction. Placement of component parts is quite critical and may require considerable experimentation. Unless the builder has had considerable experience with broadband high frequency circuits he should not undertake the construction of such units."

So there you are. It is my hope that by

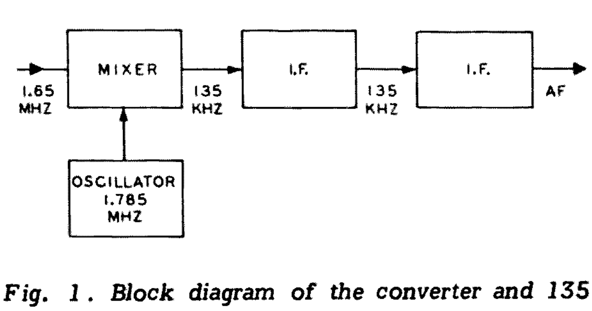

Fig. 1. Block diagram of the converter and 135 kHz i-f stage.

using my experience and by giving you all possible details, even outlining some of the troubles you can get into, that you will be able to build them.

RCA describes some nice circuits, parts of which are very useful and then says, "Home construction of this circuit should not be attempted unless the builder has had considerable experience in the winding of inductive components and has access to the special equipment required."

So we'll share our experience and give the real lowdown on the earthy details of winding and testing coils. Believe me, after 47 years (first license 2BAV in 1923) I still don't always get it right the first time.

Tools for Miniboxing the 432'er.

Let's face some of the facts of miniaturization. You're going to need a few things you may not have on hand, such as real small tools, .021 pins for binding posts, .035 figerglass boards, double-clad boards with copper on both sides, 1/8thW or 1/10thW resistors, and real small capacitors like the 3/16ths in. square ones in stock at Lafayette Radio. You will need either excellent young eyes or assisted older ones, like mine. I have a pair of glasses that magnify a little and focus at about 14 in. and a second pair that magnify about two times and focus at 9 in. I find these to be superior to any other type of magnifiers.

The most special tool after glasses is the

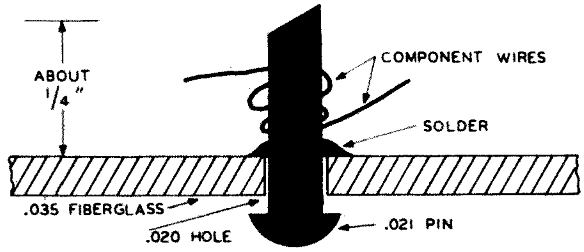

Fig. 2. Sub-miniature terminal pins.

jeweler's chuck for holding a number 76, .020 drill in a regular ¼ in. electric drill. Most of those little high-speed drills sold to hobbyists do not close tight on a number 76 drill.

I use a regular ¼ in. drill with a Variac to slow it down and clamp the small pieces of board in a drill vise. The number 76 drill comes in a little aluminum box with drill numbers from 61 to 80. You'll be well advised to buy at least a half dozen of the number 76.

The pins I use for terminal strips are called "bank pins" and are short, .021 in diameter and hammer into the .020 holes tightly. Tinned with solder and with wire around them, they will not come out (Fig. 2). If you know of any other low-cost method that is better, or smaller, please let me know.

Terminal strips can be made up as in Fig. 3, or in any other desired configuration. I generally use three pins for the transistor with one to the left for a base input coupling capacitor and one on the right with a bus

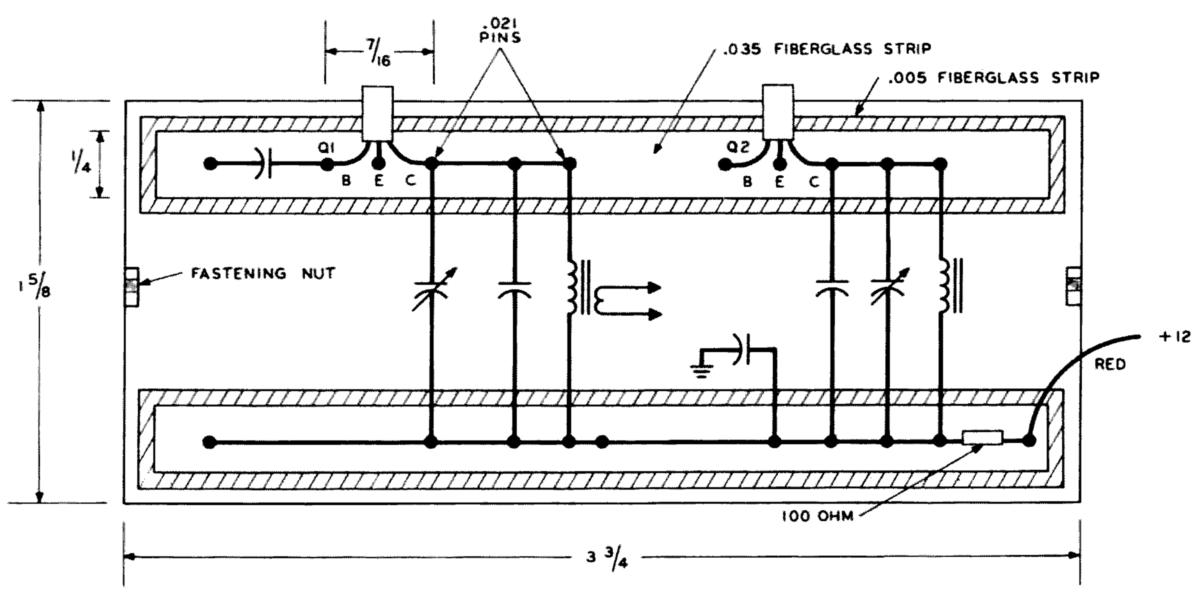

Fig. 3. Terminal strip layouts.

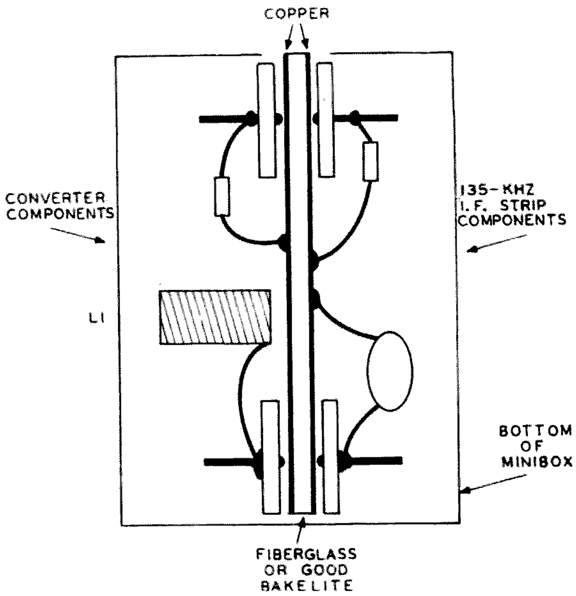

Fig. 4. Two-layer boards.

wire from the collector because the collector usually has at least three components attached to it. Cement in place for wiring. After wiring the components will hold it in place. Be sure to insulate the strip from the baseboard so the heads of the terminal pins don't short to the baseboard.

Two Surfaces Instead of One Inside the Minibox

Several methods are in favor today to save space in enclosures, some going to the extreme of three layer printed circuits and flatpacks with 30 devices inside, with an OD of ¼ x 1/8 x 1/20 in. These are the little "bugs" with 14 leads each. With LSI (Large Scale Integration) they claim they are putting two and three hundred devices (transistors) in each flatpack. They are selling them now, so it must be true, if you can believe it. These are all for logic work in computers and as far as I know have no applications for rf work.

Along with the three layer printed circuitry the flatpacks are placed on both sides of the board and the whole thing goes into a tray with an OD of only .400 of an inch. This is outside the scope of amateur work, and calls for the "farthest out" chemicals, materials, metals, and methods of testing. As amateurs we cannot go to that extent just yet, but we can put a whole station on UHF complete with batteries into less than one cubic foot!

For the two layer job described here you can use a double-clad laminate which has copper on both sides, or you can bolt two single-sided boards together back to back as in Fig. 4. This has a tendency to fill up the minibox better, which, in military circles, is called "volume density." Believe it or not, the finished unit has some pretty large empty spaces in it.

Low Frequency I-F Inductors

We have a good formula for these now, already used in the breadboard 432'er receiver i-f sections, which works well on the air, so that's the sort we will concentrate on.

The big question is whether to use variable inductance tuning or variable capacitance tuning. Most commercially available small and midget transformers use an outside threaded core which is then turned to provide a linear motion of the cup core to provide more, or less, cover over the winding, which increases or decreases the inductance. Some form of threading is used on the inside of the transformer can, but this is generally not usable for experimental work, as you can see if you take one apart.

For amateur use this whole question of i-f strip, or strips, because we're using triple conversion, is of considerable importance. The usual 455 kHz i-f jobs fall right between the frequencies we would like best for selectivity and image. The 135 kHz used here seems about as low in frequency as is practical for a low-cost i-f with good AM voice bandwidth, and furnishes excellent selectivity for the homebrewer as well as good image rejection.

Then your next i-f, going backward toward the antenna, should be – as a rule of thumb – not less than 10 nor more than 20 times in frequency, as a compromise between image and the use of too many conversions. This would put you at 1.35 MHz but you shouldn't really use an i-f in the bc band, so it is located just outside, on 1.65 MHz.

The next i-f should then be at 16.5 MHz, so we stretched things a little again and put it in the 28 to 30 MHz 10m band, which could get you into occasional trouble if you had a 10m kilowatt neighbor, but makes for a nice portable 10m receiver and is also one

of the popular i-f output frequencies for VHF and UHF converters which are on the market.

Then the rf head on 432 MHz has an image some 600 MHz away, which is fine. So there is the triple conversion and its frequency reasoning set out for you.

Meanwhile, back at the coilwinder, we are working with a little device that does the job very economically. Shown in Fig. 5 is a jig which will hold almost any coil form for i-f use. The spool of wire in use is set on the floor suspended on a ¼ in. dowel pushed through a cardboard box and the wire rolls off it nicely. Count the number of turns made around the coil for every turn of the crank. It will generally be around 4:1. This makes it easy to count the total number of wire turns on the form.

Several days were devoted to winding 135 kHz i-f conductors for the converter, the 1.785 kHz oscillator coil, and the 1.65 MHz i-f coils, tuning them up, and checking for gain and bandwidth. Coil winding data is shown at Fig. 10 (the final circuit).

A simplified jig for testing these coils is shown in Fig. 6. For test signals I used a Lafayette signal generator for the 1.65 and 1.785 MHz frequencies, and my sine wave-square wave generator for the 135 kHz. When ready to wind, a little coil wax melted onto the form helps to hold the wire in place. Put a little more over the first winding and a final touch of wax over the outer layer to hold everything in place in the core. I also melted a little down into the core. Figure 7 shows what the coil and core look like when ready to put together. Two cores are used. Insert the wound form into one core, and then put the other core over the part of the form that is outside the first core, taking care not to move or break the fine wires. Make sure that the coil form is just twice the length of one of the cores. After testing the core and coil assembly can be cemented in place on the circuit board.

Using a moving cup core for tuning was checked and dropped in favor of the mica compression trimmer, for mechanical reasons. If you are a master machinist (I am not) you could possibly turn out a plastic holder with the thread needed which is something like 11/16ths diameter and a 28

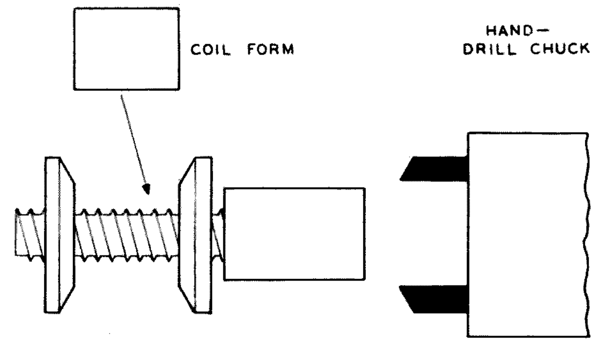

Fig. 5. I-f winding aids.

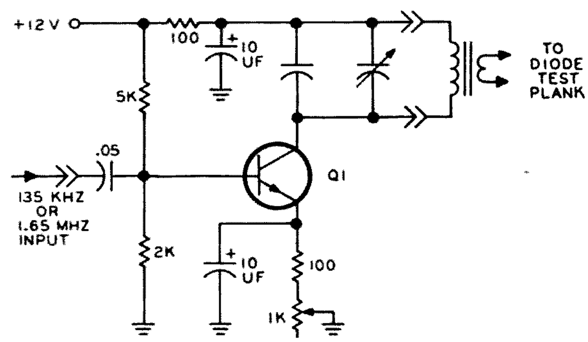

Fig. 6. Test jig, i-f coils.

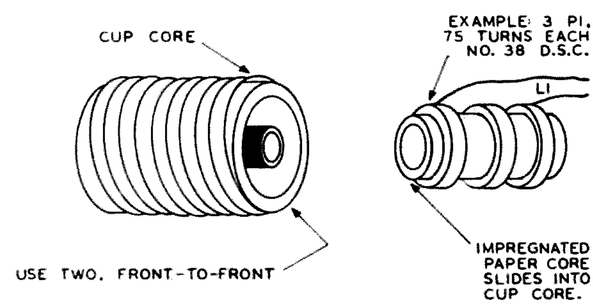

Fig. 7. Cup core windings.

thread. If not, be happy with the Arco trimmer No. 469 which varies from 130 pF to 800. Use a dipped mica where needed, as across LI at 135 kHz, in case you don't quite reach 135 kHz.

The 1.785 MHz oscillator coil was checked in a similar jig using the actual oscillator circuit as in Fig. 10.

Packaging Notes

On the average, if you are ready to build something small in a minibox, and more or less permanent, it pays to have all the components checked first. At one time you could make changes after building something in a 10 x 12 x 3 in. chassis but it's not as easy now, when you are packaging in small miniboxes. However, the two-sided board in the middle of a minibox (Fig. 4) does give you good access to both working surfaces

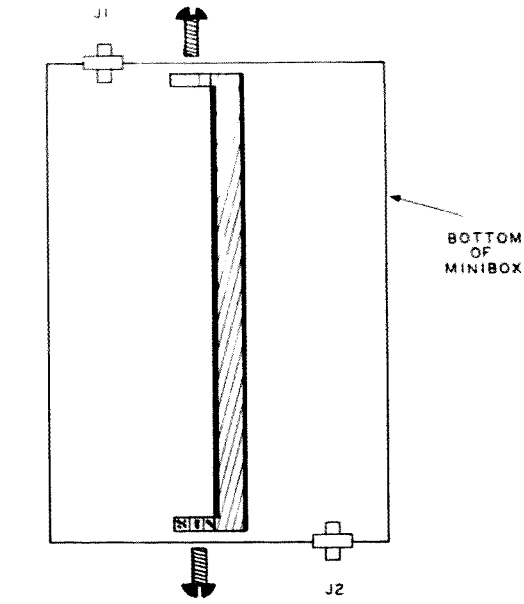

Fig. 8. Illustration of assembly, board and minibox.

for adjustment and tuning, and if you do have to make a change anywhere it is possible to do it without dismounting the whole plank.

Small Components

We're not going into microminiaturization here, just miniboxing, so we will use ordinary 1/8W resistors and profit by Lafayette Radio's little imported ceramic capacitors and electrolytics, as specified in the final circuit and layout, Figs. 10 and 11.

The Arco mica trimmers are rather large but there does not seem to be anything smaller available at a reasonable cost. The midget type 42 Arco trimmers are 3/8 wide x 3/4 long, with the number 4215 running from 210 pF to 700 maximum.

Assembly

I used brass nuts soldered to the baseboard to fasten it to the inside of the minibox as in Fig. 8.

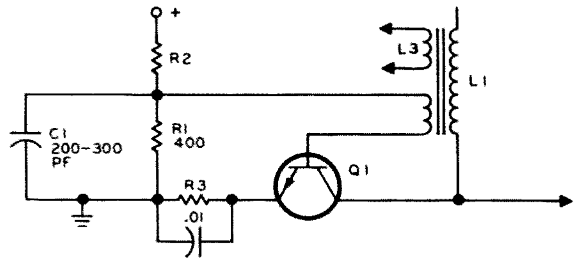

Fig. 9. Schematic of the final oscillator circuit. C1 200–300 pF; C2 .01 µF; R1 400Ω.

Fabricate the transistor terminal strip and the +12V bus strip (Fig. 3) and fasten them down either by cementing or by the use of extra pins and soldering to the baseboard.

The two sides of the double clad board can be treated as two completely separate assemblies, and tested separately also. Then a single wire from L2 on the last 1.65 MHz winding can go through a grommeted hole to the other side and be soldered to the mixer input.

The principle of a double i-f frequency with a conversion in the middle is an excellent one, allowing a lot more gain with freedom from feedback of the input to output variety. With the input on 1.65 MHz and the output on 135 kHz, none of the usual feedback possibilities are present.

Oscillator Spurious

Yes, once again, trouble in the 1.785 MHz oscillator. So we will try one thing at a time and check each carefully. First of all we should recognize that a modern device has easily over 40 dB power gain at 1–2 MHz. This means that one hundredth of a milliwatt at the input will result in 100 mW in the collector circuit which could result in a lot of feedback. So what cuts down gain? To cut it short, and save you time, the final oscillator circuit (Fig. 9) shows how the oscillator was tamed. The important items were found to be L2, C1, C2 and R1. L2 must be small, like 2 turns. C1 must be near 200 or 300 pF, no higher. C2 is all right at .01, and R1 should not be over 470Ω. The oscillator handles fine now, in fact so smooth I was bothered by news reports coming in from the "all nighters" around 1500 kHz as I was checking the range of 1–2 MHz for operation at 1.785 MHz. I was running an af amplifier and speaker after the diode and voltmeter, and the fact that the combination shown in Fig. 6 and the diode test plank result in an excellent one transistor regenerative set when R1 is lowered or L2 is decoupled to bring it out of the oscillating condition into the regenerating detector mode, brought in these bc stations. You may not realize it, but one of the criterions for a smooth oscillator is that it should do just that, with less than necessary feedback.

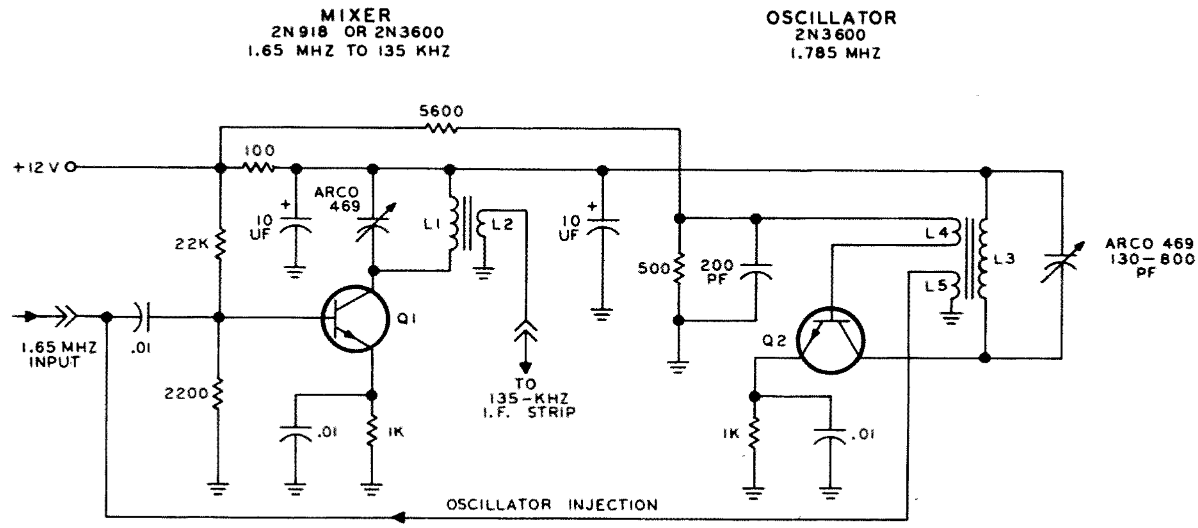

Fig. 10. Schematic of the third converter and the 135 kHz i-f stage. L1, 225 turns. See also Fig. 7. Two cores used, front to front. L2, 15 turns wound over L1 (inside the core). L3, 25 turns in single core. L4, 2 turns over L3 (inside core). L5, 2 turns over L3 (inside core). NOTE. The coupling of L4 to L3 is important. Reverse wires of L4 if no oscillation.

Just for a check, C1 and C2 were increased to 10 μF each, and heavy self--quenching at audio frequencies poured out of the speaker.

I spent another half-day on it to make sure of everything for you, as in Fig. 9. I would say it is by far the best oscillator I have ever built for the .5 to 5 MHz range, with lots of reserve power, stability and no trace of spurious radiation.

Third Converter and Oscillator Circuit

Refer to Fig. 10, schematic, and Fig. 11, layout. This circuit works well in a closed minibox, using so far only one half the space available, with the two 135 kHz narrowband stages and diodes going into the other half.

The mixer used was an RCA 2N3600, but any good NPN will do because in this section of the 432'er we're only dealing with 1 to 2 MHz. You don't need a lot of gain, you don't need hf capabilities, all you need is selectivity, smooth tuning, good avc, and the possibility of construction by the homebrewer.

Inductor details, terminal pins, and assembly, have all been detailed, so just check all values possible, and turn it on. Being an experimental type, I fed a 1.65 MHz signal into C1, tuned up the mixer collector coil to 135 kHz, connected a diode to the 15 turn

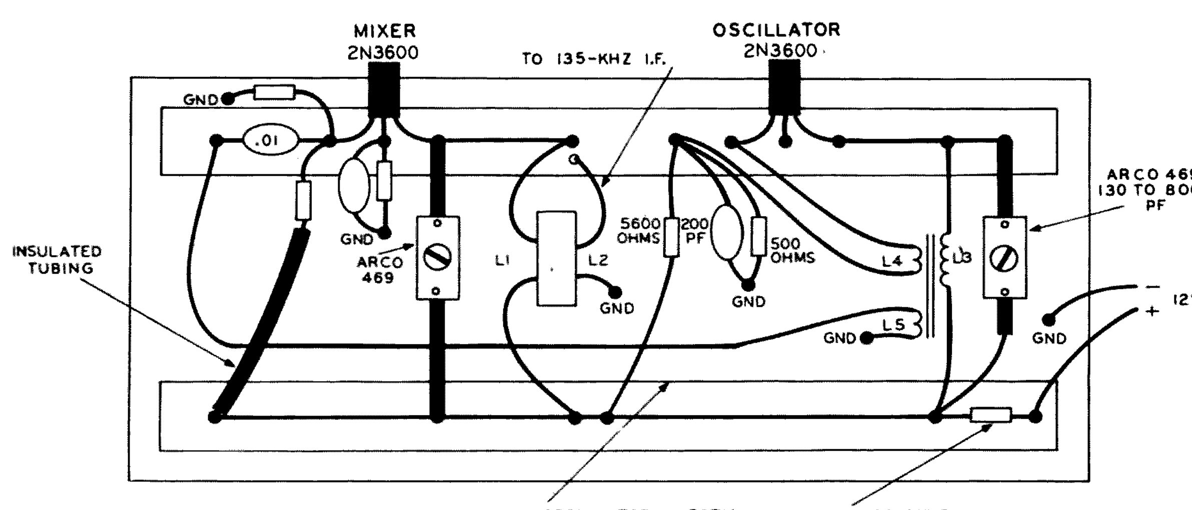

Fig. 11. Layout, third converter and oscillator, 1.785 MHz.

winding L2, and started in. As shown in Fig. 10 there is no tuning at 1.65 MHz (in this section) so the image at twice 135 kHz will be just as strong, but that doesn't matter. When the three tuned circuits of the broadband strip on 1.65 MHz are used in front you will not pick up the image. At least it will be so far down it won't bother you.

I found only about a tenth of a volt out of L2 in the mixer collector circuit, but that was enough to tune up on and listen for spurious radiation. When that winding is connected to the input base of the two-stage 135 kHz i-f strip you'll find plenty of signal at the af connector output.

...K1CLL

c/o 73 Magazine
Peterborough NH 03458

COAXIAL RELAYS ON 432 MHz

When checking things over before the last attack of seasonal madness (a VHF Contest) I took the unprecedented step of making some measurements on the send-receive coaxial relays. The figures were measured at 432 MHz, but the 144 MHz numbers can be expected to be only ten times better, and ten times better than crummy is not very good. For the benefit of the nonboffins, the isolation is given in power into the receiver per hundred watts of transmitter power. Figures for everything matched and terminated – with my luck things would be mismatched in just the wrong direction, but that's more work to measure.

How much leakage, applied repeatedly, will harm a receiver?

Two watts will cook some antenna coils.

A transistor like the 2N5109 will take 25 mW.

The 417 or a 6CW4 will probably stand as much.

A WE-416 I had kept cooking at around 10 mW.

Crystal mixers, such as the 1N21E, can take 10 mW if the dc resistance is under 50Ω for the mixer circuit.

The 2N2857 or 2N3478 will take 5 mW safely.

Microwave transistors or the TI XMO5 will only stand about 1 mW.

The leakage power per hundred watts that I measured:

Dow-key (N connector, shorting type) Transmitter side (normal open) – (26 dB); Receiver side, shorting barrier – 1 μW (80 to 96 dB) (Varied).

MA 7524 (rated 3 GHz) – 0.1 μW (90 dB).

Thompson products (Meshna) stripline type, round can, N connectors – 25 μW.

Rotary type, BNC, 28V #501 147 – 1 mW.

BNC, D-K type 315 – 10 mW.

BNC, FXR type 318, terminating resistors – 10 mW.

Advance, N connectors, extra contacts (standard ten meter relay except for connectors) – 25 mW.

Note that the last one is still plenty adequate for protection of a nuvistor or a 2N5109 on 144 or 220 MHz in a matched coaxial system. The 2N5109, which is a two watt transistor, will give 3 dB noise figure on 220 MHz if the bias is set up for 2 to 3 mA (it's rated for 50). Maybe that's what we need for a reliable rf stage?

...W1OOP

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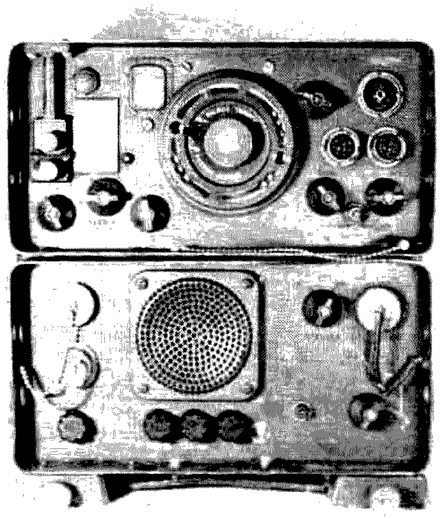
12811 Owen Street
Garden Grove CA 92645

The AN/GRR-5 Receiver



Unconverted AN/GRR-5 Receiver.

An interesting arrival on the surplus market is the AN/GRR-5 communications receiver. Its low price (around $50) and its wide coverage make it particularly attractive. The receiver tunes from 1.5 to 18 MHz in four bands. Other features include a built in 200 kHz crystal calibrator and provision for presetting ten channels with an ingenious mechanical channel selector.

As issued, it will operate from 115 Vac, 6, 12 or 24 Vdc or from a dry battery pack. The i-f is 455 kHz. The complete set consists of receiver R-174 and power supply PP-308 mounted in cabinet assembly CY-615. It has served nicely at this station for RTTY reception, and as a tuneable i-f for VHF experimentation. The preset detents are great for both applications as they facilitate quick monitoring.

Most of the receivers I have checked out were in good condition. Circuit diagrams are mounted under the bottom plates of the two units. To operate from the ac line simply connect the line cord to pins A and D of the power input plug J-103. Changeover from dc to ac is automatic. To operate from 6, 12 or 24 Vdc it is necessary to switch to the desired voltage and connect the positive lead to pin B of J-103 and the negative line to pin C of J-103.

Unfortunately, the set has a couple of failure modes. These receivers were designed in the early 1950's before the availability of silicon rectifiers. A selenium rectifier is used for filament rectification (CR 102 mounted on the case). A copper oxider bridge rectifier powers the ac transfer relay, and a high vacuum rectifier is used for the B+.

If the receiver doesn't work when plugged into the ac line and the fuse is ok, check to see if relay K-101 has pulled in. If it hasn't, the trouble is most likely the copper oxide rectifier CR 101. This is prone to failure from corrosion and can readily be replaced with a standard 1 Amp, 50 piv silicon bridge rectifier assembly. Incidentally, carefully inspect the receiver before you purchase it. The set is beautifully fungus proofed, but the relays aren't. I have frequently found the armatures corroded to the point where they won't actuate. This brings us to the second failure mode.

Transfer relay K-1-1 is the most common victim of corrosion. This is an 11 pole double throw relay. In the event it is bad the only solution is to completely rewire the power supply. Fig. 1 is the schematic of a new supply built from existing components. This power supply can also be used in the event you obtain a R-174 receiver without the PP-308 power supply. The output of the supply is adequate enough to power additional accessories such as 2nd i-f/ discriminator modules from R-257 or R-394 receivers* to provide FM reception. Removal of unused components from the PP 308

***These modules are available from Fair Radio Sales, Lima Ohio.**

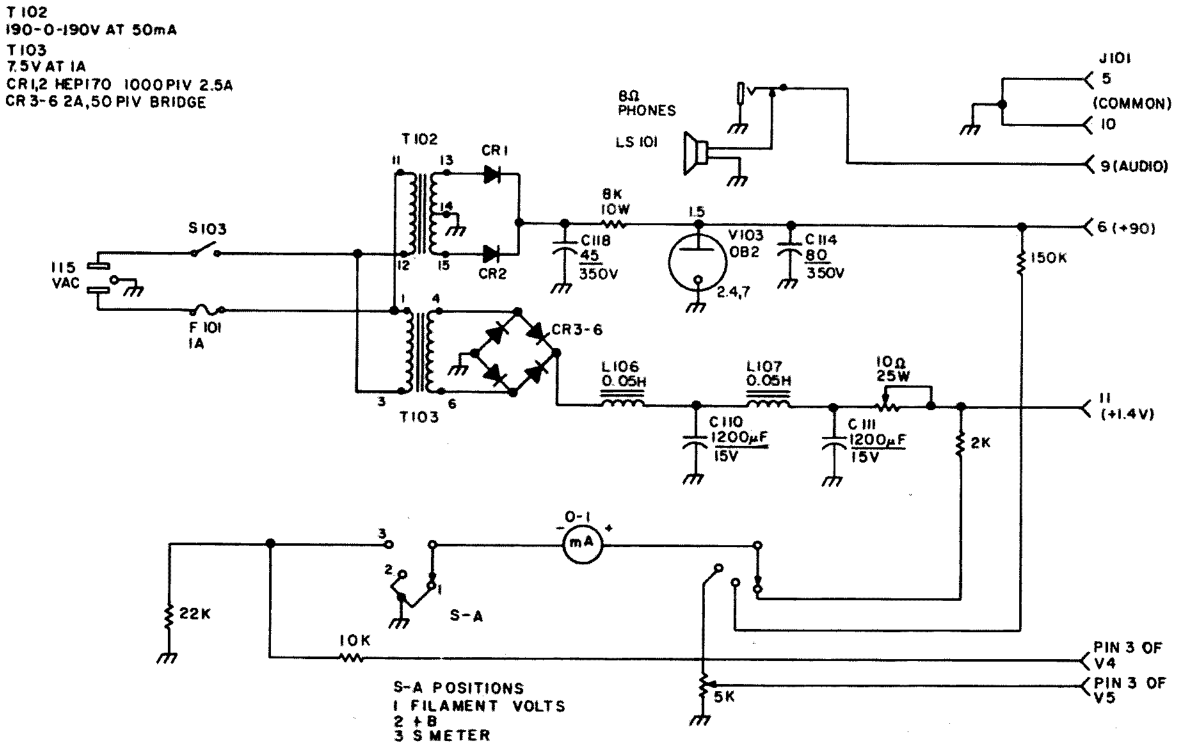


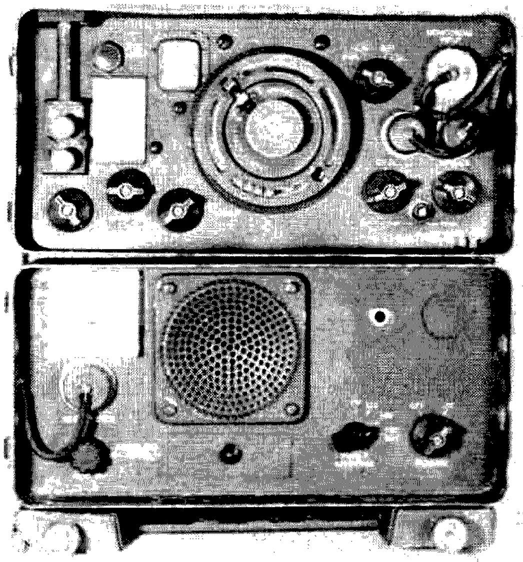
Fig. 1

results in plenty of room to mount these modules.

The meter shown in the schematic permits monitoring and adjustment of the filament voltage, monitoring of the B+ and it also functions as an S meter. In adjusting the filament voltage, start with the 10 ohm 25 W resistor set for maximum resistance. The audio output selector should be set at the high position. Adjust the slider for 1.4 Vdc under full load. This will result in about 1.5 V when the output selector is in the low position.

The closed circuit jack was installed in place of the speaker on/off switch. This permits use of 8 ohm headphones, or an extention speaker. The blast proof military speaker is great for listening to CW or communications traffic, but for short wave listening it leaves something to be desired. If you have 600 ohm headphones you can replace one of the jacks on the receiver (J-1 or J-2) with a conventional phone jack. Other small modifications can improve the operability. The twist type antenna connector should be replaced with a BNC connector if you are going to use the receiver as a tuneable converter. If you mount the converters in the rebuilt power supply, receiver relay K-1 can be used to transfer the antenna to the converter. A short piece of RG-58 cable is connected to K-1 with the center conductor going to pin B (clip the original wire going to that pin), and the shield terminated at the relay ground lug. A switch to activate the relay is then mounted on the panel of the power supply.

. . .W6JTT



AN/GRR-5 converted with S meter and conventional phone jack.

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Using TTL in a FREQUENCY DECODER MODE

While taking stock of cash outlays already made on our (Echo Amateur Radio Group) moonbounce, Tropo, Oscar installation being built at my QTH, it was noted that a large portion of the total investment was being used for the repeater function described by me earlier (73 Magazine, November 72, p. 271). It is our final goal to be able to license a repeater that complies with the new FCC rules and regulations (alone a feat!) and repeats out anything it hears on the EME, Tropo, or Oscar link onto a 2m FM transmitter on some unused simplex frequency. The user can then return or originate a call from his own home via his 2m FM transmitter to my QTH and have it repeated out on the EME, Tropo, Oscar path. Money being what it is (scarce!), this should explain the first reason why this construction project was dreamed up.

Computer Thinking

Some better type of *Touchtone decoding was required if we were going to stay within our limited budget and prove EME, etc., need not cost an arm and a leg if done on a group basis and then shared by using a repeater to access the site. Since decoding by any of LC, twin-T, active filters, or Phase Locked Loops (PLL), require test equipment and tuning, none of them are easy or particularly inexpensive. It was the cost of eight PLL ICs that drove me to keep thinking and come up with the way used in this article.

Since decoding is generally done by some type of filtering, and I had almost resigned myself to it, the test equipment was checked over to make sure all was O.K. since lightning hit here last month. It should have come to mind sooner, but it did not until I got to the frequency counter. I thought I was going to need to align things. Then the lights began to flash up in the grey matter between my ears. If a frequency counter were used as the decoder, the same unique decoding of the incoming tones could not only be done, but displayed in easy fashion.

I have already built the frequency counter described by K2OAW, presented last year in 73 Magazine, and between that and my job, I realize the availability of inexpensive TTL ICs necessary to build a counter. For the K2OAW model it requires 32 TTL ICs, and would hardly seem to be cheaper – it's not. But then you don't need 20 MHz capability for openers. Secondly, you need display only one number for HI tones and one for LO tones, if you desire the display at all! The frequency counter (counters) you

IND	IS
62	1
63	2
64	3
66	A
72	4
73	5
74	6
76	B
82	7
83	8
84	9
86	C
92	*
93	Ø
94	#
96	D

Chart 1. Display

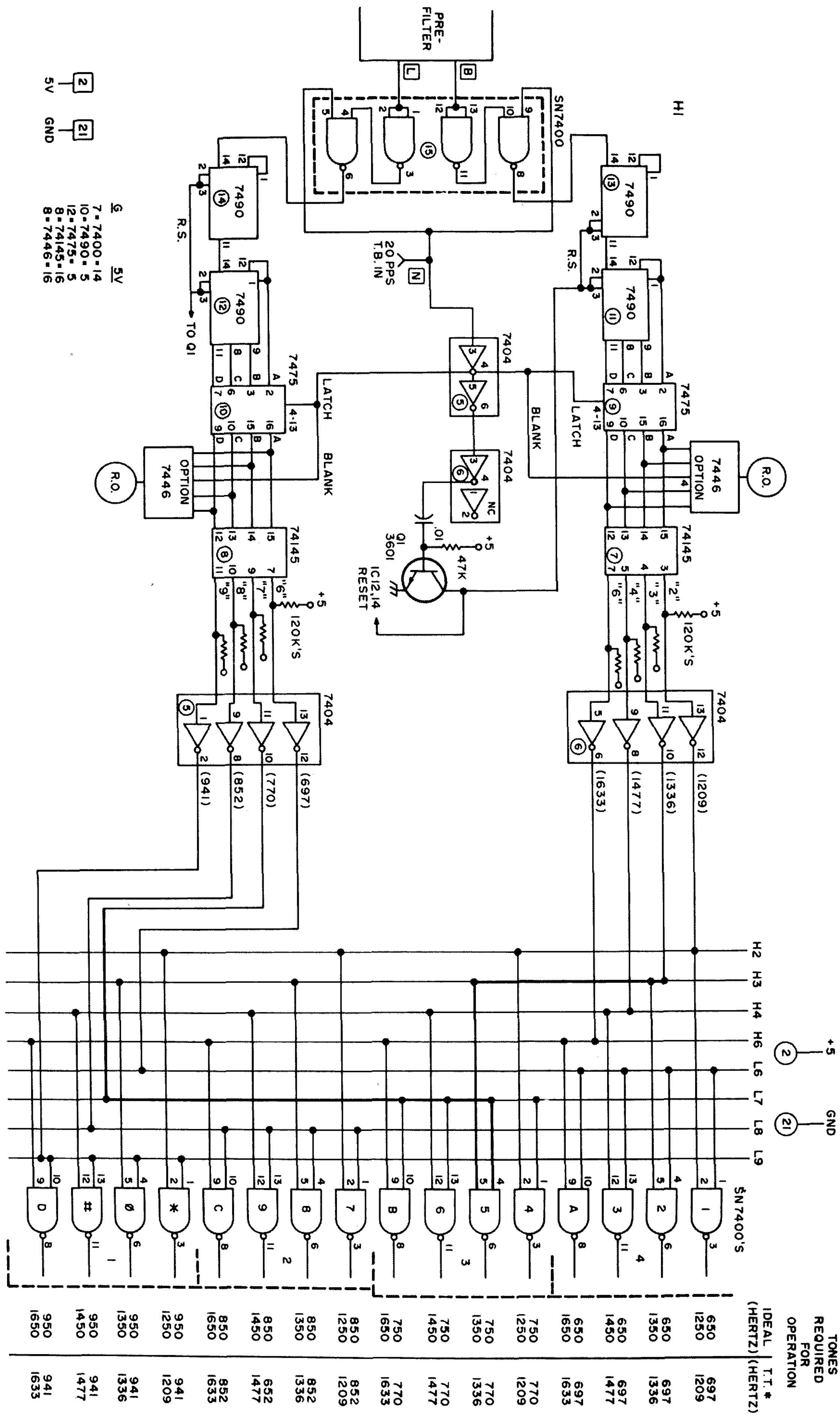

PRE-FILTER
SN7400
7490
7475
74145
7404
7446 OPTION
R.O.
LATCH
BLANK
R.S.
TO Q1
20 PPS T.B. IN
Q1 3601
47K
IC12,14 RESET
120K'S
(941)
(852)
(770)
(697)
(1633)
(1477)
(1336)
(1209)
H2 H3 H4 H6 L6 L7 L8 L9
+5
GND
5V
G
7-7400-14
10-7490-5
12-74175-5
8-74145-16
8-7446-16
SN7400'S
TONES REQUIRED FOR OPERATION
IDEAL (HERTZ)
T.T.* (HERTZ)
650 1250 — 697 1209
650 1350 — 697 1336
650 1450 — 697 1477
650 1650 — 697 1633
750 1250 — 770 1209
750 1350 — 770 1336
750 1450 — 770 1477
750 1650 — 770 1633
850 1250 — 852 1209
850 1350 — 852 1336
850 1450 — 652 1477
850 1650 — 852 1633
950 1250 — 941 1209
950 1350 — 941 1336
950 1450 — 941 1477
950 1650 — 941 1633

Fig. 1.

really need for this job never has to "count" over 2000Hz by the nature of the input, and really never over 200Hz due to the counting scheme I used. As can be seen in the logic diagram in Fig. 1, there is very close similarity between the HI and LO tone groups, and for this reason I will refer to them as the hi channel (processes 1209Hz, 1336Hz, 1477Hz, and 1633Hz) and the LO channel (processes 697Hz, 770Hz, 852Hz and 941Hz).

Circuit description and functions:

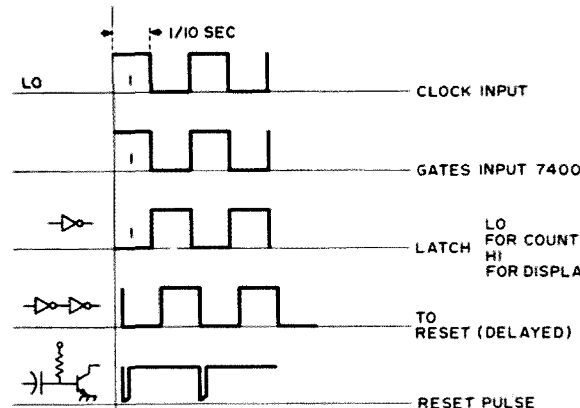
I will cover the various functions in the following manner:

- HI channel
- LO channel
- Clocking and control
- HI and LO to digit decoder
- Pre-filters (to split groups)
- Power supplies
- HI channel

The input to the HI channel is taken from the HI pre-filter output and applied to both inputs of one NAND gate of an SN7400 (IC15, pins 12 and 13). This shapes the input sine wave to the square wave required by the TTL logic. From the output of this IC (pin 11) the square wave is passed on to one input of a second NAND gate (IC15, pin 10). Each time the input here goes HI it half enables the gate. The HI required for the other input of this gate (pin 9) is supplied by the clocking and control section and will be covered in that section.

Assume for the moment the HI is present from clocking and control. This HI allows the tone applied to the gate (pin 10) to be passed out of the output of this gate (pin 8) and on to the first HI channel counter (IC13). It is inverted from the input to this gate, and in phase with the original input, but it does not really matter for our use.

The HI tone enters the first counter (IC13, SN7490) on pin 14. The IC is wired as a ÷ by 10. If you look at the output at pin 11 with a scope or counter you will, however, see 1/100 of the input tone frequency. This is due to the gating used from the clocking and control. From the output of this counter (IC13, pin 11) the signal is routed to a second counter, also wired as a divide by 10. The second counter (IC11) input is on pin 14. Pins 1 and 12 of both



	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Chart 2. Timing

counters in both channels are tied together, pins 6, 7 and 10 are grounded, all pins of 2 and 3 are tied together and to the collector of Q1 for reset, all pin 5s tie together and to +5V and pin 14 is the input for all counters. This wiring is for the four HI and LO channels only, and is correct for the ÷ by ten function they perform.

The point of all this can best be shown by an example. If 1209Hz were placed on the input to the SN7400 gate and it was gated properly, the proper BCD code would appear on the output line of the second counter IC11. For 1209Hz, the 2 is the digit we are interested in. By proper gating, this two is on the BCD output lines at the end of the "gated on" or count period. The gate is then shut off and the output used to control IC9. Since the BCD is changing as the counter counts, we cannot use the BCD directly to a decoder. Only when the BCD code is right for the number representing the input can we use it. Something is needed to allow the BCD code to travel on only when we want it to.

This something is IC9 (SN7475). By wiring this IC in the correct manner, it only "transfers" the BCD input to the output when its clock, or latch, lines are HI. This is pin 4 and 13 of each IC (one per channel). The clock control supplies this HI only at

the proper time. When the HI is applied, the BCD is transferred to the outputs. From these outputs, the code is sent two ways if you choose to run a display. I suggest you do, as it is a great check of everything to this point as you build the decoder, and a terrific troubleshooting aid in the future.

The BCD code is applied to a BCD 7-segment decoder that will depend on the type of display you use. In my case, I used SN7446s, as I used *Numitrons for my readouts. The blanking line (pin 4) is tied into the clock control, so that only the transferred number is displayed. A ' flicker ' in the readout is normal and it tells you the clock control is running. The board layout will vary somewhat depending on your choice of readouts, but all the decoder circuits remain the same.

The second place the BCD code is applied is to a BCD to decimal decoder (IC7, SN74145 or 7445). This IC takes the BCD code present on four lines and converts it to a single output LO at line 2 (pin 3) in the case of our 1209Hz example. The four used outputs in each of the HI and LO channels are committed to +5V thru 120K resistors. These resistors hold the uncommitted collectors of the IC at a HI until that particular number is received and decoded. In the HI channel, only when the numbers 2, 3, 4 or 6 representing 1209Hz, 1336Hz, 1477Hz and 1633Hz, is received, encoded to BCD by counting, transferred by the latch and decoded by the decoder, will there be a LO at the proper decoder output. It will remain there as long as the tone is being received.

Due to the decoding used by section D to get two decoded tones to represent only one number, a TTL HI is needed from the decoder output. I have added an invertor to the outputs in the form of IC6 (SN7404), to get them right side up. There are six invertors per IC, but only four are used on the

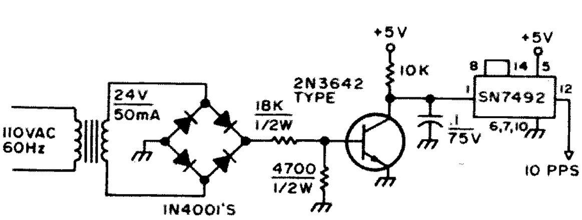


Fig. 2

outputs you want to monitor. The extra pair are used in the clocking and control section. The outputs from pins 12, 10, 8 and 6 are now ready to go to section D for final decoding.

LO Channel

I mentioned the similarity of HI and LO channels earlier so that at this point I can say they work identically. Note the difference being the counting of information from the LO tone prefilter, and the use of different output lines of the decoder. IC8 in order to decode a 6, 7, 8 or 9 representing 697Hz, 770Hz, 852Hz or 941Hz. It should also be said here, that if you are making your own pads to be used on the sending end, center them on the 50Hz points (i.e. 650Hz, 750Hz, 1350Hz, etc.) and it allows you a ±50Hz error in tones before a malfunction occurs in the decoder. This may interest some of you, and I hope to have our control pad finished soon for a follow up article to this. The fact you can have a 50Hz error in input tones really is not leaving yourself "wide open," as you still must have two tones to actuate anything. Any of you using our type of pad, where the tones are all 50s can reduce this to a ±10 cycle tolerance very cheaply, and I will include this with the pad article. Other than the changes mentioned, the LO channel is identical to the HI channel.

Clocking and Control

This is the "brains" of the system, just as in any counter, so be careful to get things right here. In order to speed the operation of decoding by more "samples" per second, and to lessen the parts required, a readily available time base was used. Namely the power line frequency. If you operate from other than 60Hz, you will have to modify the time base accordingly. What you desire as an output from the clock is a 10Hz *symetrically* shaped square wave. Note, to function properly, the output must be 10Hz and symetrical, and this is not how TTL necessarily works. For 60Hz, run a bridge rectifier from a transformer as I did, and divide it by 12 in an SN7492, IC16. This is a symetrical division if the IC is wired as I did mine, and you have your clock rate very easily.

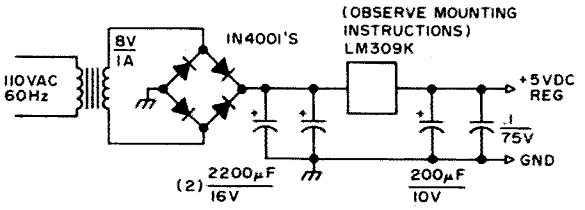


Fig. 3

In parts A and B, a HI was required to turn on the count enable gates (SN7400). The 10Hz clock rate from the clock control may be applied directlyto these two points (IC15, pins 5 and 9), and it will allow the gates to count for the portion that the square wave is HI. This is a sneaky way to again divide the input frequency by ten, since the gate only allows the counter to look at 1/10 of the incoming frequency. This shifts the decoded or displayed digit one more place to the right, and reduces both channel counters required by one.

Now that the gates have been turned on to count, next you must do something with what you have counted. In the center of Fig. 1, the 10Hz is passed to one inverter of IC5 (SN7404) by attaching it to pin 3. As the clock goes LO after allowing a counting period with its HI, we would like to transfer that count to the display and decoder. That transfer requires a HI applied to IC9 and 10, pins 4 and 13 of both. We have a LO at the clock input point, but after the inverter it is now a HI. This is applied to the four pins stated causing a "transfer." Your numbers are now decoded and displayed.

Now all that remains for the clock control is to reset all the counters for the next count. Since, for this type of decoder, we want the output lines to remain LO as long as the tones are present, we cannot reset the counters anytime while "transfer" is taking place. In order to keep all of this very inexpensive and the clock control simple, there is only one other time we can reset the counters. That is during the period when we are supposed to be counting. If it were done immediately as the latch line were returning LO, the counters might "see" their reset or zero position, and transfer this. Since we may later choose to decode other than the four numbers of the HI and LO channels stated here, zero might be a valid command for us, and we didn't want any outputs that did not represent a valid frequency input. For this reason, the counters do indeed reset right at the beginning of the count. A "delay" introduced by passing the output of IC5, pin 4, through two more inverters, IC5 (in pin 5, out pin 6) and IC6 (in pin 3, out pin 4) keeps the false decoding of the zero mentioned above from happening. Note, you invert twice, therefore no inversion takes place, but you do slow down the signal being passed by what is called the TTLs propagation delay. In this case, about 8 to 15ns per inverter. This LO is then ac coupled from IC6 to pulse the transistor (Q1) off very briefly, disabling the count and resetting the counters. Q1 is held on to enable the counters by a small bias applied through a 47K resistor to +5V from the base. The combination of delay and the pulse width of the reset pulse is the amount of incoming frequency that will be "missed." For those of you who worry about built in errors, the total lost time is less than .2ms out of a 50ms count window. This is not enough to worry about or affect the significant digit you are trying to count.

HI and LO Channel Output To Single Function

This has been described many places before and is quite commonly used even with PLL type tone decoders, so I will not go into detail here.[1] It uses SN7400 NAND gates. Wire the inputs in this manner: one to a HI channel output and one to a LO channel output. When these both go HI (after the inverters), the output goes LO giving a one of sixteen number possibility the same as that sent.

Prefiltering

Here, too, any filter used for the PLL decoders will work,[2] or the LC type used for RTTY if they have enough bandwidth when retuned to 563 to 1075Hz (LO), and 1075 to 1767Hz (HI). Just remember to use only enough amplitude to and from the prefilters to make the input shapers in the first SN7400 work. Monitor pins 6 and 8. This takes 0V to +5V input levels, so rectify the filter outputs to keep minus off the SN7400, but do not put any capacitors here. The

explanation why not is partly obvious and partly too long to explain here, just take my word and don't. Set the input amplitude to the filters until nice square waves are found at pins 3 and 11, and at 6 and 8 if the clock is running. At pins 6 and 8 they will appear as bursts of square waves. I would offer some of our prefilter here, but it has stiffer requirements and the PLL type works just fine.

Power Supplies

Use any power supply required by the type of prefilter you use. The 741C op amp IC runs nicely from +10V, which can be gotten from the bridge output of the supply shown, for +5V regulated by using a resistor and zener combination. My +5V supply is shown in Fig. 3, and is "borrowed" directly from the repeater control article by K2OAW in March 1973, 73 Magazine. Any well regulated +5V supply capable of 900mA-1A works well in this application. Incidentally, repeater owners, that repeater control worked very well the first time I fired it up.

I am now repeating my call automatically all over the basement like a kid with a new toy – hi!

General

With everything wired and running the readouts should both flicker on "zero" with no input and display as in Table I, when tones are coming in. If you know the tones, just arrange your readouts with the LO to the left and HI to the right. Remember, the digit shown represents the "hundreds" of cycle column of the incoming frequency. With the clock line from clock control open the displays should blank. By using the displays you can check the gating and logic by applying only one frequency at a time from an audio generator to each input gate without the filters in place. In this case set the generator to the 50Hz points to allow for drift and read the readout in that channel for the significant digit (i.e. 6 for 650Hz). My sending pad is set up to send single or dual tone for just this reason.

Using the display, you can divide the system just as I did to describe it in order to localize difficulties. Get the time base going first, then the supply, then the channels one at a time, then the final decoders and last, the prefilters. This way you can check it out as you go. My offer of you sending an SASE for help still goes, as I have not been totally buried by mail from the last article.

Conclusion

This decoder is not difficult to follow and is quite precise in operation with no tuning, so repeater control should be a natural for it. *Make sure* your pads are on frequency if they are commercial though. If you use them instead of my pads you are rather close to the edge of our passbands in places (i.e. 697Hz), so act accordingly! I am trying to come up with a board layout, but my own is wired and it took less than one afternoon. Best of building.

*Tradenames

1. Source unknown, but definitely borrowed.

2. L-C type and active type: Ham Radio, January 1973 P25 and P26 FM Repeater Decoder.

... **W9CGI**

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2427 Clark Drive
La Marque TX 77568

Simplifying Satellite DXing

Use this steerable antenna.

OSCAR-6 was up, and once again it caught me before I was ready. The Swan-270 and an 80/40 dipole couldn't hear it. Fortunately, a 75A-3 became available locally, and attached to a 10 meter dipole running due North-South five feet above the house roof, I was able to hear OSCAR-6. With the 75A-3 and dipole combination we encountered a lot of QSB and signals weren't very strong. What could be done, and for "peanuts?"

What Type of Antenna?

Since the QSB appeared to be due to changes in polarization, an antenna had to be selected that would pick up both vertical and horizontal polarization. This eliminated the dipole and yagi – leaving quads, deltas and commercial crossed-polarization antennas. The experience of W5RK indicated that for DX work the delta was better than the quad, so the delta loop was chosen.

The original concept was to use a 4 element two-meter quad and a two element ten meter delta loop. Because we had an eleven element 2 meter beam we used that, and built a 10 meter 2 element delta loop (about 7 dB gain) for receive.

The Steerable Mount

Lightning usually is bad luck, but this time it served us well. We picked up a lightning struck Ham-M ($30) and repaired it ($7.50) to use as the horizontal rotator. The azmuth rotor was a TV rotor with the mast fitting through the rotor and extending on both sides so we could mount an antenna on each end.

The Ham-M and assembly was mounted on a 10 foot two inch mast tied to a piece of wood 4 x 4 sunk 2½ feet into the ground. A 25 foot tower would be better, thus the Ham-M could be mounted inside and the tower provide an additional bearing surface for sideways torque. (See Fig. 5.) This mount has 360 degrees horizontal rotation and 180 degrees in azmuth (from horizontal to vertical and on over to horizontal again.)

Delta Loop Antenna

The antenna is designed for 29.5 MHz

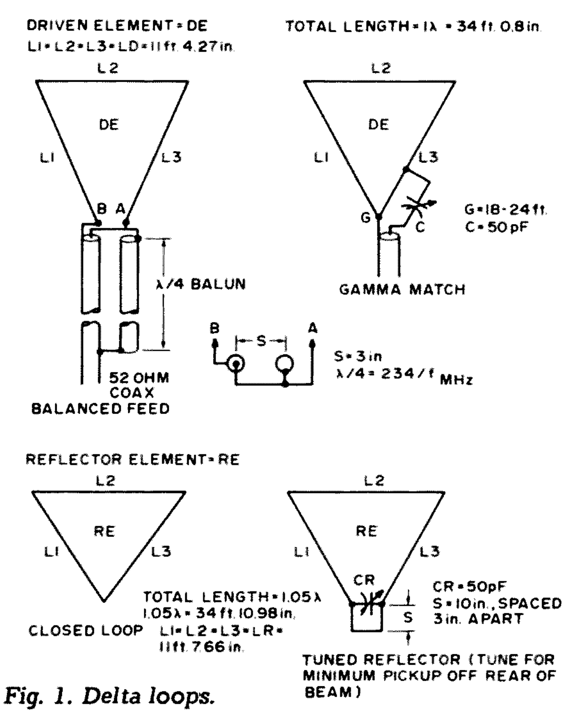


Fig. 1. Delta loops.

with a driven element and a reflector separated about 0.125 wavelength. The driven element is one wavelength and the reflector is 1.05 wavelengths. Radiation impedance is about 70 OHM's, but I used a 52 OHM balanced feedline. For optimum performance the delta should be mounted at least 3/4 wavelength (25 feet) above ground. (Fig. 1.)

The six spreader arms are made of bamboo (or cane) poles, each 7½ feet long. The wire loop is strung through holes drilled at about 7 feet on each pole. Each set of three poles is mounted on an equilateral triangle of ½ inch (3/4 inch could be used) outdoor or marine plywood measuring one foot on each side.

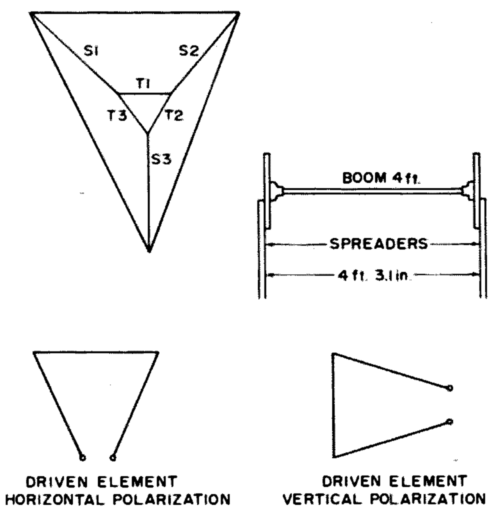
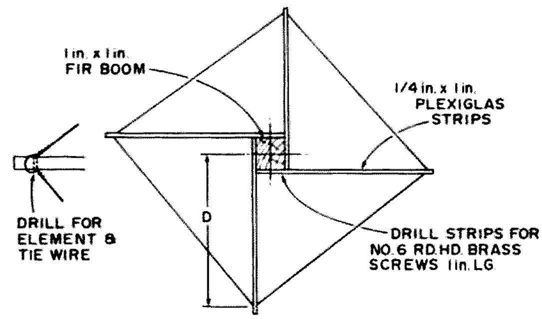


Fig. 2. Delta mechanical construction.

The delta boom is a four foot section of one inch galvanized water pipe with a pipe flange at each end. The plywood triangles are fastened to these flanges with bolts instead of screws. The overall separation of the driven and reflector elements is 0.125 wavelength (4 feet 3 inches). The delta boom is mounted to the transverse boom with U-bolts. (Fig.2.)

Reflector and driven elements were made of #18 plastic coated stranded hook-up wire (separated zip cord might be better). Stranded wire was used, rather than solid, because it is more resistant to damage by the wind flexing the delta. Coated wire is preferred because we have a very high corrosion problem this close (13 miles) to the Gulf of Mexico.

The reflector may be a continuous loop, or it can be tuned with a stub. We used a continuous loop without a tuning stub. The total length of the reflector is 1.05 wavelength (34 feet 11 inches at 29.5 MHz).



ELEMENT	TOTAL LENGTH	ONE SIDE	D
DRIVEN	6 ft. 10 3/4 in.	20 3/4 in.	14 2/3 in.
REFLECTOR	7 ft. 2 7/8 in.	21 3/4 in.	15 2/3 in.
DIRECTORS	6 ft. 6 5/8 in.	19 2/3 in.	13 7/8 in.

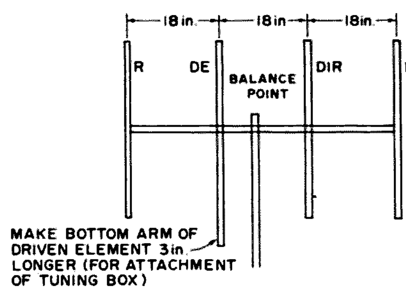


Fig. 3. Two meter quad (W5ZG).

The driven loop is one wavelength in total length (34 feet 1 inch at 29.5 MHz) and fed with a balanced 52 Ohms using a quarter-wave length balun. Seventy-two Ohm feed would be a better match, but I had only 52 Ohm coax on hand.

When the delta loop is fed at the down point, it is horizontally polarized. When the feed point is at one side or the other, the polarization is vertical. (Fig. 2.)

Two Meter Antenna

I used an 11 element beam, vertically polarized, but I would recommend a four element quad. I plan to replace the beam with a quad when I have time to build it.

Fig. 3 shows the design of a four element quad. The spreader arms are made of ¼" by 1" plexiglass strips. Two holes are drilled in the end of each plexiglass strip; one hole for the wire element and the outer hole for a tie wire. Make the bottom arm of the driven element 3" longer than the other three arms (for attachment of tuning box). Each element is separated 18 inches from other

elements. The boom is wood 1" x 1" and five feet long.

The two meter quad driven element is 6 feet 10¾ inches in total length, the reflector 7 feet 2 7/8 inches, and the directors are 6 feet 6 5/8 inches.

Transverse Boom and Mounting

The transverse boom is a 1½ inch water pipe (actually an old mast section) which is mounted through the elevation rotator. Two holes are drilled at each end for the U-bolts. When I have time the mount will be changed to that in Fig. 5 because of better balance.

Currently the elevation rotor is mounted on a Tee-connector and a short section of pipe forming the stem of the Tee is mounted in the Ham-M. The Ham-M is then mounted

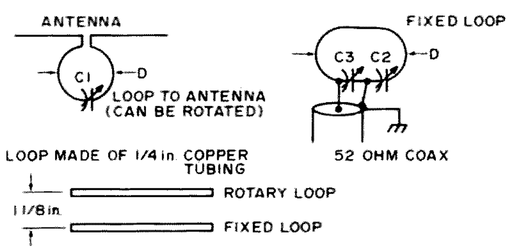


Fig. 4. Beam matching, rotatable (W5ZG).

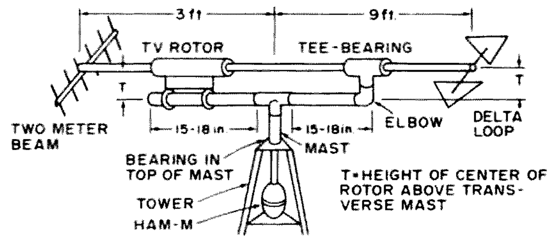


Fig. 5. Torque mount.

on the ten-foot pipe mast. A better mount is given in Fig. 5.

Delta Data

Design frequency = 29.5 MHz, gain = 7.4 dB (at 0.125λ).

Spacing between element: 0.125λ (4 feet 3.1 inches); 0.08λ = 52 Ohm rad. resistance; 0.13λ = 72 Ohm rad. resistance.

Height above ground = minimum of 3/4 (24 feet).

Antenna match = either gamma match, or balanced.

Quad Data

Design frequency = 2 meters; Spacing between elements = 18 inches; Antenna matching = rotating loop; See Fig. 4.

...WB5ASA

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How I Blew a Bundle on TTLs

Over the past year or two, I have been building a variety of ham projects which use digital integrated circuits, usually the 7400-series TTL ICs advertised in almost every issue of 73 Magazine at bargain prices. But being basically stingy, about a year ago I tried to get these same ICs even cheaper, and wound up getting a lesson in economics – you pays for what you gets.

What caught my eye was an ad for "20 unmarked ICs for only $1.98 – three packages for $5." Wow – 60 ICs for $5 – that's less than a dime a piece! Now, I know that there are hundreds, perhaps thousands of different ICs by now, and identifying these unmarked ICs would be hard – almost impossible. But the nice part of this advertisement was that they were already partially presorted – you could buy a package of all digital, or all linear, or mixed, and there was even an assortment of "...all 7400-series TTL." That was the clincher – after all, there aren't that many different 7400-series ICs, and since they are similar anyway, right? My greed won out, and I ordered $5 worth.

When they arrived, identification turned out to be even easier than I thought, for I soon came up with some tricks (which we shall describe in a moment, in case you are still tempted after you finish reading this story). I went to work, and a few hours later had the 60 ICs divided up into three piles:

1. 20 good 7400-series ICs.
2. 22 partially working 7400-series ICs.
3. 18 other ICs, which were either completely dead, did strange things and could not be identified, or else were identified as being something other than a 7400-series TTL IC.

The 22 partially working 7400-series ICs were definitely identified as to what they were, but usually had some defect such as an open pin; most of these were gates with one input not working, or flip flops with one output not working. Thus these ICs could be used in some circuits as long as the non-working pin was not needed.

The 18 dead, unidentified, or non-7400-series ICs included some which were completely open on all pins (maybe they were empty packages?), some which did not seem to do anything in particular, some which we could identify as to what they did but could not find a type number for them in any of our catalogs, and two which were identified as Texas Instruments DTL digital ICs.

And so we wound up with 20 good ICs for $5, or about 25¢ a piece. That seems like a good buy, except that I found that some of the ICs, though perfectly good, didn't fit

into any of my immediate needs. For instance, there were six 7474 Type D flip flops, and five 7481 sixteen-bit memories. The remaining nine good ICs were all NAND gates of one kind or another. Put another way, we found that buying this type of variety pack was a chancy job at best and, in my case, definitely not worth the time, effort, and money. (But you may want to compare my results with an article entitled "Identifying Unmarked Surplus Digital ICs" in the September 1972 issue of CQ Magazine, page 44. I guess you have to be a born gambler.)

But, if you are still not discouraged, you may be interested in the tricks mentioned earlier. I was lucky to have two pieces of equipment which made the job much easier, though you could do without them. The first is an IC test socket, which is simply a 16-pin IC socket mounted on a board, with two pin jacks connected to each IC pin. It is then very easy to make connections to each IC pin using jumpers or test leads. Another device which could be used for the same purpose is the IC test jig made by EL Instruments and also by API.

The other device is called a Digi-Viewer, which was described in a Popular Electronics article some years ago, and which is now available in kit form from Southwest Technical Products. It is simply a box with 16 bulbs (mounted in two rows of 8), a small power supply, and sixteen amplifiers, which is connected by a 16-wire flat cable to an API IC clip. This is a connector in the form of a clamp, which slips over a DIP IC and makes a connection to all 14 or 16 pins of the IC at once. In this way the box connects to an IC, and the 16 bulbs then mohitor the logic level of all the IC pins at the same time. This device is suitable for digital ICs only (RTL, DTL, or TTL), and though it looks useful, we have found that this particular job

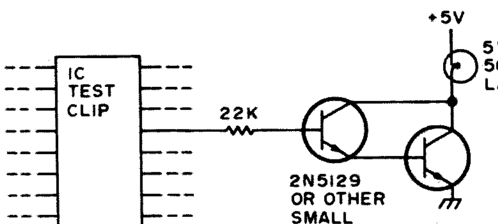

Fig. 1.

of identifying unmarked ICs was virtually the only time we used it. To make sure that the bulbs do not load down the IC under test, each bulb is driven by a Darlington amplifier, as shown in Fig. 1.

The last piece of equipment was a 5V regulated power supply.

The first job in identifying these ICs was to find which pin is the ground connection and which is the +5V pin. Most 14-pin 7400-series ICs use pin 7 for ground and pin 14 for +5V, while most 16-pin TTL ICs in the 7400 family use pin 8 for ground and pin 16 for +5V. But there are a few 7400-series ICs which use other ground and power pins, and so I didn't want to apply power to the usual pins for fear of burning out some of the unusual ICs, which are usually the more expensive ones, too.

And so, I came up with the following procedure. I plugged the unknown IC into the test socket, and then plugged the Digi-Viewer clip over the IC. I also connected the Digi-Viewer ground lead to the ground side of the +5V power supply, but made no other connections. Since the IC has neither a ground nor a +5V connection at this point, there can be no voltage on any pin, and therefore all lights on the Digi-Viewer are off. Now take a test lead, connect one end to the positive side of the +5V supply, and touch the other end to each pin of the IC, one after another. When you connect +5V to an IC pin in this way no destructive current can flow through any pin, since all pins are floating except for the 22K base resistors in the Digi-Viewer (remember, there is no ground connection to the IC as yet).

Interesting things happen when you start touching the +5V lead to the various input, output and power leads. The TTL inputs are applied directly to emitters of NPN transistors, so applying +5V to the emitter reverse-biases the base-emitter diode and no current flows. As a result, no current gets through the IC to the other pins, and all the lights on the Digi-Viewer (except the one which connects to the pin you are touching) remain dark. For the same reason, touching an output pin also reverse-biases some junctions, and again all lights except one stay dark. But touch the +5V lead to the IC ground pin or to the V_{CC} pin, and all the

Digi-Viewer lights connected to active IC pins go on! Only defective pins or pins with no connection show a dark lamp. This is because various sneak paths exist through forward biased diodes and resistors within the IC from the V_{CC} and ground pins to all of the normal input and output pins.

So here we have a simple test to identify the ground and +5V (V_{CC}) pins of the IC; we still don't know which is which, but that is easy. If we find that the live pins are 7 and 14, or else 8 and 16 for 16-pin ICs, then the answer is easy since these two connections are standard. If the two live pins are some other combination, just look through your TTL catalog until you find something similar. In fact, there may be only one device with the particular pair of pins used for power and ground, in which case you have just made an important discovery.

The next step is to find out which of the remaining pins are input pins and which are the output pins. We start by applying full †5V power to the IC, still keeping the Digi-Viewer connected. At this point, some of the tester lamps will light; some of these may be connected to input pins and some to output pins. An important characteristic of TTL ICs is that any input pin with no connection to it is assumed to be at a high level (logical ONE, or about +3 to +5V, enough to light its Digi-Viewer bulb). Hence, every input pin will cause its associated bulb to light, as will some outputs. Take a 330Ω resistor and connect from ground to each of these pins having a 'high' level lighting a bulb. If the pin is an input pin, the 330Ω resistor will load it down enough to make the light go out. On the other hand, output pins are generally 'active-pullup.' meaning that an on transistor is used to make them go positive. Hence a 330Ω resistor to ground will not substantially change the voltage, and the bulb will stay lit.

This test will usually find all of the ICs input pins, and also some of its output pins. For instance, as you ground the input pins with the resistor, you may suddenly find one of the dark lights going on – this must then be an output which comes on when an input is grounded. If the light goes dark again when you remove the 330Ω resistor, then most likely you have a NAND gate of some sort; if it stays on then you probably have a flip flop of some kind. So at this point you can start to make all kinds of guesses about what kind of an IC you have. (But some kinds of outputs – so-called open-collector outputs – are hard to find since they do not have any pullup. You find these by trying a 1K resistor from suspected output pins to +5V.)

Having thus separated the input pins from the output pins, we simply connect various combinations of grounds to the input pins and watch the outputs. We use grounds, since as we mentioned earlier, a no-connection to an input is the same as a high or ONE level; hence we must actually ground an input to force it to a low or ZERO level. In some cases, just knowing which are the input pins is enough to identify the IC; in other cases we have to do a little experimenting and guessing. Most TTL gates are NAND gates, whose output goes high (lighting the bulb) whenever any one (or more) of the inputs is grounded; these are very easy to spot and identify. Inverters are also easy to find since their output goes high whenever the input is grounded. NOR gates are harder since you must ground both inputs before the output goes high.

Flip flops are sometimes hard to find, but with patient digging you can be 100% successful here too. Most will toggle (though not reliably) when you ground and unground their T input; this identifies the T input and also finds the two outputs. Then try to find the set and reset inputs; once you have these you should be able to identify the IC by leafing through your TTL catalog.

The hardest ICs to spot are the complicated ones. Most ICs you get in the bargain bag are SSI (small-scale-integration) meaning that they are simple ICs containing at most a couple of gates or flip flops. Don't expect to find many MSI (medium-scale-integration) ICs, and give up on LSI (Large...) ICs altogether, since they usually come in larger packages. I did get some of the 7481 sixteen-bit memories, but failed to get anything really useful like a decade counter, a latch, decoder/driver or something of that sort.

... K2OAW

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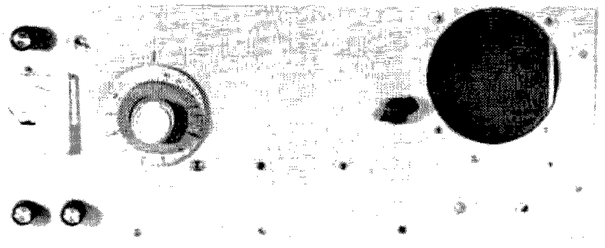

THE R-511, A REAL SURPLUS BARGAIN

The familiar Command receivers of World War II vintage were unquestionably the single most popular piece of electronic surplus of the post war era. During the Korean war the Aircraft Radio Corporation produced a similar appearing series for use in Army liaison aircraft. Although this article is primarily concerned with the conversion of the R-511 low frequency receiver, the basic power supply will power any of the series.

The most commonly encountered units are:

R-511	190 – 550 kHz
R-22	550 – 1500 kHz
R-509	108 – 135 MHz
R-508	118 – 148 MHz

In addition, there are a variety of companion units such as the T-366 transmitter (116 – 132 MHz) and the CV – 431/AR converter for use in the 228 – 258 MHz band.

The equipment differs radically from the World War II series. Loctal and miniature tubes are used, and the circuitry reflects a complete redesign. Also, there are no dials on the units!

The low frequency receiver was converted to fill a variety of needs in my shack. In addition to its use for receiving weather reports, copying marine CW traffic and monitoring the 500 kHz distress channel, it finds use as a selective i-f strip and as a piece of test equipment when working with surplus mechanical filters.

The first step is to construct the power supply as shown in Fig. 1. There are two versions of the receivers, one for 14 V input,

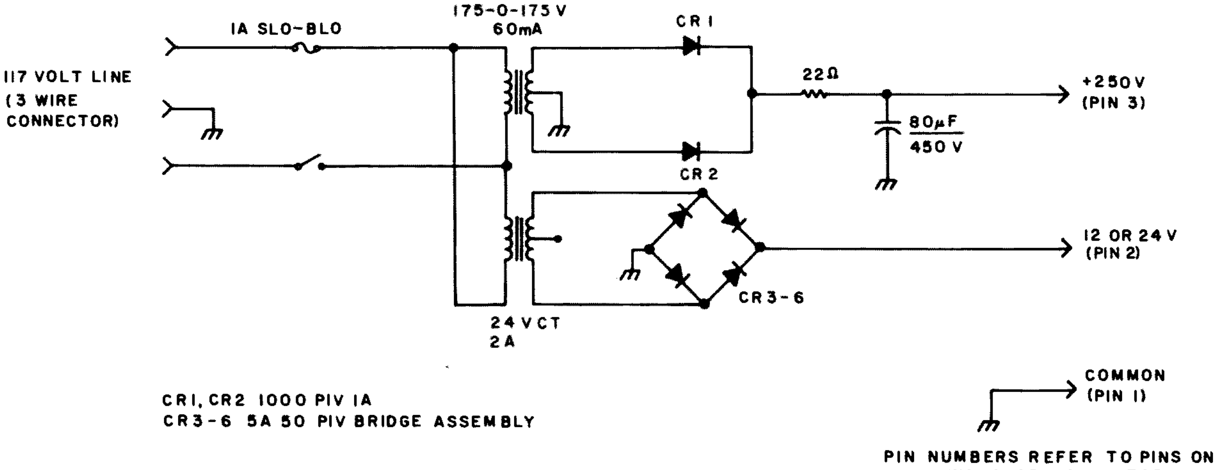

Fig. 1. Command set power supply.

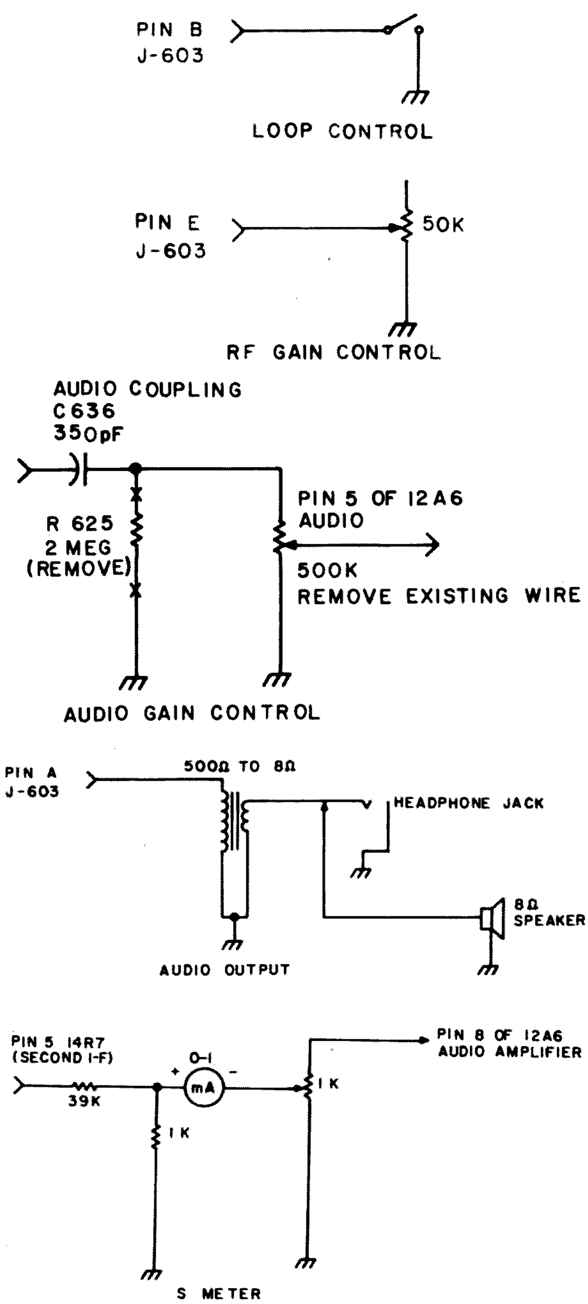

Fig. 2.

the other for 28 V input. Set the tap on the filament transformer for the desired voltage. Although ac can be used on the filaments, use of dc results in lower hum levels, and permits operation of the antenna switching relay in the R-511 without any rewiring.

The next step is to connect the gain control from pin E of J-603 to ground. Make sure that there is a jumper between pins A and E of J-606. This is the connector that is in the spot the dial used to occupy. On the VHF receiver, the gain control is connected from pin E of J-302 to ground. In addition it is necessary to jumper pin B of J-302 to ground. This is the cathode resistor of the last af stage. The receiver can now be checked out. Headphones are plugged into the Tel jacks. A temporary tuning shaft can be made by prying the eraser out of a pencil and forcing the metal sleeve over the tuning spline.

Once the receiver is operating the dial assembly can be installed. The best approach is to obtain a Jackson planetary drive. Remove the housing from the tube compartment, and discard it. Remove the shield from around the tuning capacitor. Next remove the triangular shaped plate from the worm gear assembly, and the worm drive. This requires driving out the small drift pin with a punch. The planetary drive is simply mounted on the ¼ inch shaft of the tuning capacitor. The set is then mounted to a standard panel as shown in the photograph.

Final conversion consists of the addition of a speaker, S meter, audio gain control and antenna control switch. The circuit modifications for these additions are shown in Fig. 2. The audio gain control is essential for two reasons. First for the S meter to operate properly the rf gain control must be kept set at maximum, so provision must be included to control the volume. Secondly, by having separate rf and af gain controls the operator can adjust for optimum signal to noise.

Table 1 Plug Connections

Power Input Connector	Pin	Function
J-301 or J-602	A	+ Low Voltage (14 or 28V)
	B	Ground
Control Connector		
J-302 or J-603	A	Headphones, 600 Ohm
	B	Loop relay (LF receivers) AF Cathode, VHF receivers
	C	Ground
	D	+ Low Voltage
	E	Sensitivity (rf gain control)
	F	Low Voltage from power input connector
Accessory Unit Connector		
J-303 or J-606	A	High voltage to receiver
	B	Headphones
	C	Ground
	D	+ Low Voltage
	E	+ High voltage from dynamotor

Note: Consult TM 522-22 for VHF sets, AN 16-45-122 for LF sets.

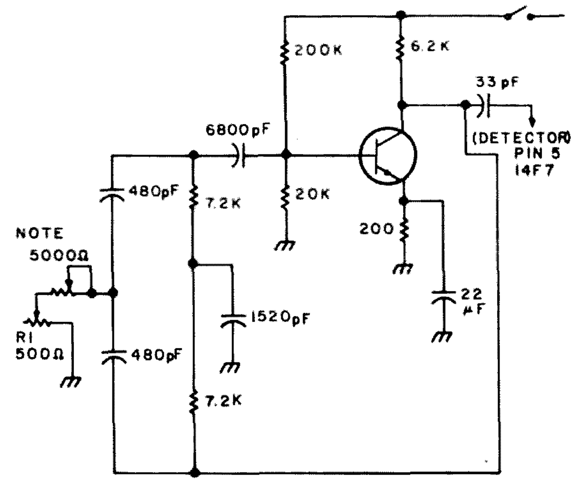

Fig. 3. Adjust for 85 kHz output with R–1 set to midpoint.

The R-511/ R-11 series incorporated a noise limiter at the expense of the bfo. Since a bfo is essential for most of my work I incorporated the circuit shown in Fig. 3. Provision for shifting the bfo frequency from the front panel is provided by R-1.

The above conversion is readily done in a few hours time, resulting in a compact high quality receiver at a modest price.

. . .W6JTT

MAKE YOUR OWN AIR CORE COILS

Air core coils wound with small diameter wire are often very hard to keep mechanically stable. Here is a simple method that I have used many times to reinforce small home brew coils.

Take your newly wound coil and momentarily connect it across a 12 V car battery charger. Hold it across the battery just long enough for the coil to reach a temperature that will melt plastic. It only takes a few seconds, so be careful not to over heat the coil.

Now, with your other hand, take one of those readily available clear plastic coffee stirring sticks and melt it into the coil turns by holding it flat against them. Let it cool and trim off the excess plastic. With a little practice you can make very professional looking coils in a matter of a few seconds.

. . . VE3FEZ

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THEFT, THE HAM and HOW NOT TO BE A LOSER!

The new car pulled into the old-timer's driveway, and a very youthful lad hopped out.

"Hi, did you copy me ok on the way from the dealer?"

"Sure did, young fella, just how much gear have you got in that car?"

The lad opened the door wide, and the old-timer noted a first-rate transceiver, power supply and swr bridge mounted beneath the dashboard. "Tommy, you've done a real good job of installing your equipment, but have you given any thought to protecting it?"

"What do you mean? I've fused all the lines and made sure that I installed ignition bypass capacitors."

"Tommy, that's not the protection I had in mind. I figure you've got maybe six hundred dollars worth of ham gear in the car – have you got that investment protected?"

"I'm not sure . . . maybe I should install a burglar alarm or something . . . "

"Tommy, it's that 'or something' that you should pay attention to. With an investment as large as yours, you should do more to protect it than just install a burglar alarm or keep the doors locked. Come on inside – we'll have a cup of coffee and I'll explain what I mean – don't forget to lock the car, first!"

The two hams entered the house and sat at the kitchen table. The old-timer brought out a pencil and paper along with two steaming cups of coffee.

"Tommy, the first thing any ham should do when he installs his equipment anywhere is to record all of the serial numbers and put this list away in a safe place, together with the bill of sale for the equipment. Second, let's take a look at your auto insurance policy. Do you have it in the car?"

"Yes, wait one and I'll get it."

While Tommy went for the policy, the old-timer stoked his battered pipe and waited.

"Here she is."

"Ok, let's look at the fine print – seems like you are covered for property damage, liability, collision and uninsured motorist . . . hmmm, that's in order . . . but let's take a long look at your fire and theft policy. Good! Just what I was hoping for – you've got comprehensive."

"What's that mean?"

"Basically, Tom, that means anything firmly affixed or attached to the car as an accessory will be covered for fire or theft. A lot of times people don't take the comprehensive theft package, and when something

happens they find that they weren't insured for their losses. It might not be a bad idea for you and me to load up my Polaroid and take a ride down to Mr. Jones' office, who is a notary public."

"Any special reason, old-timer?"

"Yes, one of the best – now would be the best possible time to establish that the equipment is really firmly mounted in your car."

"Ok, I'm game, but why do we need a notary and a Polaroid?"

"What we will do is shoot a number of photos of the equipment installed in your car in the presence of Mr. Jones. He, in turn, willl note on the back of the photo that he observed the equipment mounted in your car and will verify the serial numbers, and apply his seal over the whole works. This will establish proof that the equipment is mounted in your car and that the serial numbers agree. In case of loss, this becomes valuable proof for you when you submit a claim to your insurance company."

"Old-timer, you're putting me on. This seems like a lot of unnecessary work to go through. I always lock my doors and never leave the keys in the car!"

"Tom, come on downstairs, I want to show you something."

They went down to the old-timer's workshop, where on top of a shelf was a bent transceiver mount. The old-timer blew the dust off it and set it down on the bench.

"Tom, this is all I have left from the six meter rig I used to have in my car. I locked my doors, and wasn't away more than five minutes, but when I returned, the vent window had been sprung, and the rig, my car radio, and a jacket were gone."

"Ok, I'm sold, let's go over to Mr. Jones' office and get it over with!"

Theft of amateur radio equipment and audio accessories is on the increase. In order to protect your investment, record your serial numbers, have proof of installation, and be sure you have insurance coverage – either a comprehensive auto-theft policy – or maybe one of the homeowner's insurance policies that cover personal belongings . . . and always remember to lock your car and take the keys with you. . . . W9KXJ

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Albuquerque NM

An Incredibly Versatile Transistor Checker

Build this tester, amplifier, oscillator, etc.

Transistors have been around long enough to become obsolete but the manufacturing processes still seem to be a bit unpredictable. A little study will show that two transistors carrying the same number and both from the same manufacturer, can differ by as much as 1000%.

With this spread there is no end to the variety of units you could get under a single type number. To an old tube man this is like putting the same number on 6L6's and 6AQ5's.

While variety can be the spice of life it can certainly foul things up if you are planning to design a new circuit or if you are trying to change a transistor in an old one. You can design a circuit right by the book and then find that even though you purchased the correct type of transistor it will not work with your values.

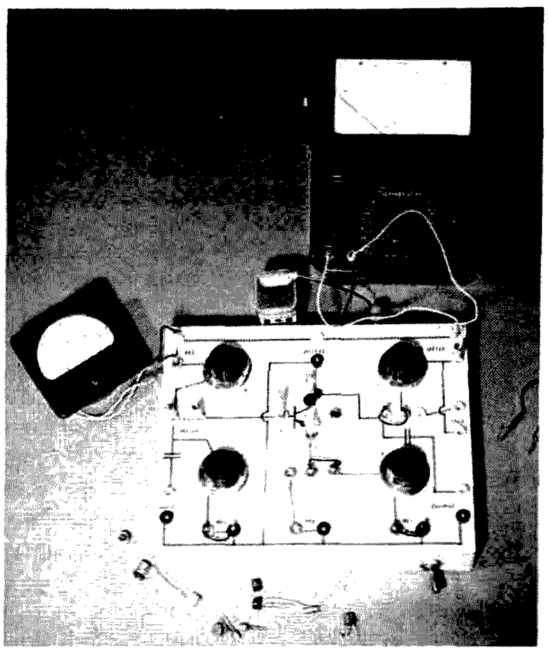
I became a little tired of trying to out guess the specs so I built a little gadget to do the work for me. I call it the "second-guesser." It not only helps solve design problems but it is also an interesting learning device for those who are just getting acquainted with transistors. It can also be used as a transistor tester, a complete one stage amplifier, or as an oscillator. With a little care and attention it might be trained to do other chores around the place.

How It Works

The unit is really an in-circuit tester. It is a tester to check the operation of a particular transistor in a circuit similar to the one you plan to use later. When we built the tester we wanted it to be versatile, but it also had to be simple. So we built it as a small patch panel type of substitution board. With the patch system you can mock up or duplicate almost any circuit in a matter of seconds with only four variable resistors, two capacitors and a handful of phone tip jacks.

When a new circuit has been set on the tester and has been adjusted for the desired operating characteristics, the current and

voltage can be read at any point in the circuit by using the tip packs. The resistor values selected can be read from the dial settings. After correct current and component values have been determined with the mock-up, it is safe to assemble a firm circuit. This method can also save printed circuit boards from many of the hazards of



The meters can be any of a suitable range that happen to be around.

cut-and-try changing of parts. The same method will work to determine bias values when a replacement transistor must be installed in a piece of existing equipment.

Most transistor circuits can be simplified to one similar to the one shown in Fig. 1. The operating characteristics will be determined by the values of resistors A, B, C and the load L. Operation of the circuit can also be influenced by interaction of resistor values and transistor characteristics.

In some circuits A, B, C and L will all be used, but in other cases one or more resistors may be missing. The problem is to determine the values to use that give the results you want from a particular transistor you plan to use.

The circuit of the tester is shown in Fig. 2, and it was designed around the basic circuit of Fig. 1. The tip jacks make it possible for additional circuit elements to be added if they are needed. In addition the

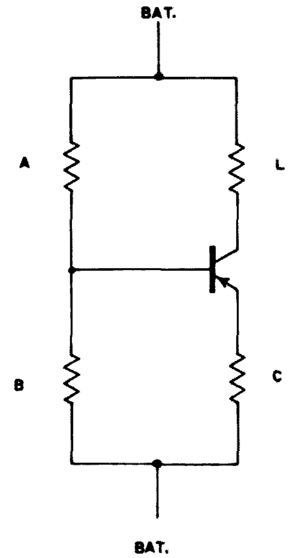


Fig. 1. Most transistor circuits can be simplified to one similar to this.

jacks make it possible to take voltage and current readings at any point in the circuit. The resistors A, B, C and L are variable and were selected to provide the most used values. If special sizes of resistance are needed they can be added with tip and clip leads.

The load L can be either the internal resistor or it can be an external resistor or transformer plugged into the proper jacks. Adding the input and output coupling capacitors makes the unit a complete one-stage amplifier for special tests or experiments. The connections to the transistor under test are also brought out to tip jacks. This makes it possible to use various clip arrangements for the many types of transistor connections.

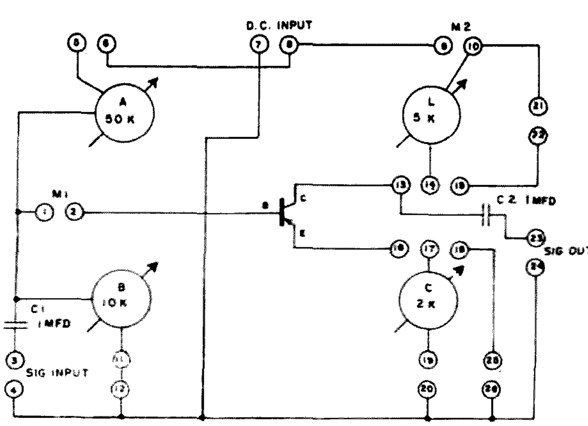


Fig. 2. The tester circuit shown here is designed around the basic circuit of Fig. 1.

Construction

Construction is very simple. It can be built on anything from a piece of pressed wood to a metal chassis. I prefer the metal chassis, as shown, because it provides for better grounding. A good ground is sometimes needed to prevent oscillations which show up with high frequency transistors. It was a temptation to make the entire unit quite small. However with a larger chassis the schematic can be drawn on the top. If the schematic is in view at all times it is much easier for the operator to visualize the circuit while the patches are being set up for a new idea.

Short patch cords or jumpers were made from flexible wire and phone tips. These cords are used to complete the circuit when external connections are not being used. Wire-wound variable resistors are used for better stability and power rating. The knobs are calibrated so that approximate resistance values can be read directly. If an accurate value of resistance is needed, the little jumpers can be removed and the resistance read direct from the jacks with an ohmeter or bridge.

The chassis was given a coat of light-colored automotive touch-up paint from an aerosol can. The schematic was put on with a wick tip pen; however very narrow black tape can be used. If high frequency transistors have a tendency to oscillate, it may be necessary to bypass the leads close to the transistor with mica or ceramic capacitors.

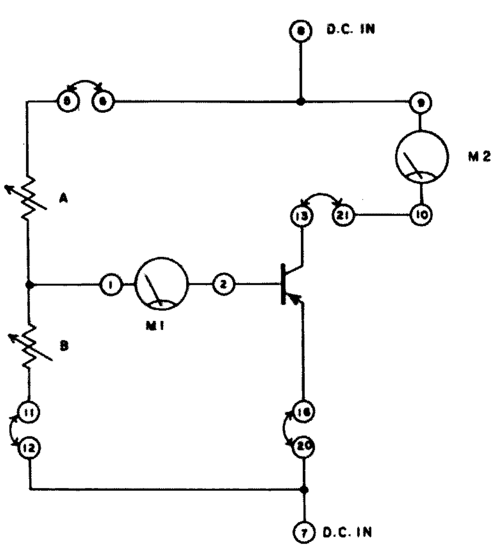
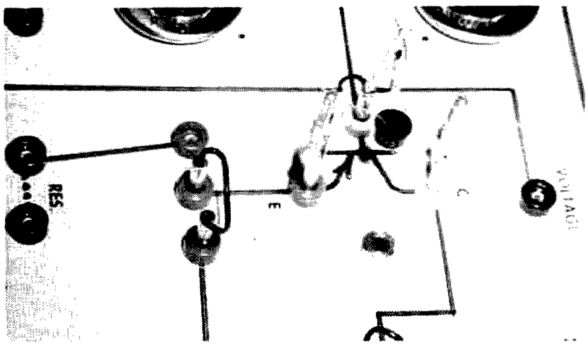


Fig. 3. A simple transistor test circuit.



Clips soldered to phone tips will hold almost any transistor.

Operation

Operation of the tester is simple. With the schematic spread on top it's like playing an electronic game. You need only a basic circuit in mind and you are in business. We don't have enough space to cover all of the possible circuits but the schematic in Fig. 3, is a good starter.

If this circuit is set up on the tester it can be used to find the gain of a transistor as a common emitter amplifier. It will also show the effect on gain and current when different values of resistance and supply voltage are used.

Many other test circuits can also be put together by referring to a transistor manual or text.

In all of the schematics the numbered circles represent tip jacks, and the curved arrows between them indicate that a jumper is plugged in. The meters can be any of suitable range that happen to be handy. All jumper connectors should be in place and the circuit complete, with the transistor, before the supply voltage is connected. Always be sure that resistor A is at maximum resistance and that resistor B is at minimum resistance before power is applied the first time for any new set up. With the resistors in this position the currents will be minimum. Increases in current should be made slowly and monitored with the meters.

If the transistor being tested is a PNP, connect the supply voltage positive to jack 7 and the negative to jack 8. If the transistor is NPN, connect the supply negative to jack 7 and the positive to jack 8. Base and collector currents can now be set to desired values by adjusting resistors A and B slowly. The gain or beta will be the ratio of the base current

to the collector current. This is the dc gain factor. If the ac or dynamic gain of a transistor is needed the next circuit may be of help.

When the jumpers are placed as shown in Fig. 4, the tester becomes a complete one-stage resistance-coupled amplifier. It is useful in finding the values of resistance, voltage and current to use with a particular transistor and to find the ac gain of a transistor-circuit combination. A signal can be fed to the input and compared with the output signal while adjustments are being made. It is useful for finding the dynamic gain and for checking out the "grab-bag" variety of transistors. It is also nice to have when substitutions must be made.

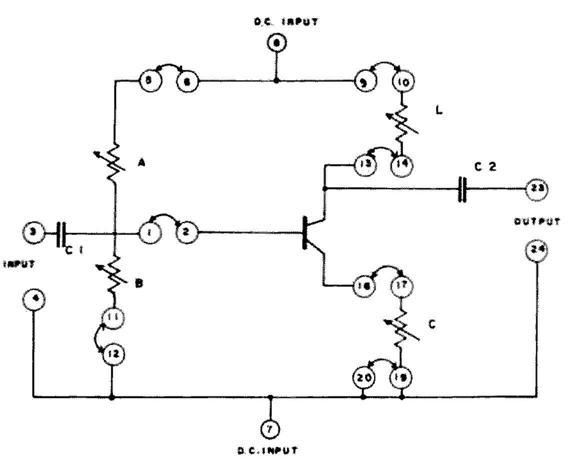


Fig. 4. The tester is now a one stage amplifier.

The circuit of Fig. 5, is almost the same as the one in Fig. 4, except the load resistor has been replaced with an output transformer. This can be used to simulate or design audio output stages.

With a little practice all sorts of amplifier and oscillator circuits can be arranged. However, in its present form the top frequency is probably limited to a few megahertz. This could be increased somewhat with careful layout and construction.

Those who are interested in other types of solid state devices such as SCR's and unijunctions will also find the gadget useful. It can be used for unijunctions as shown in Fig. 6. This circuit will oscillate at a frequency determined by the combined value

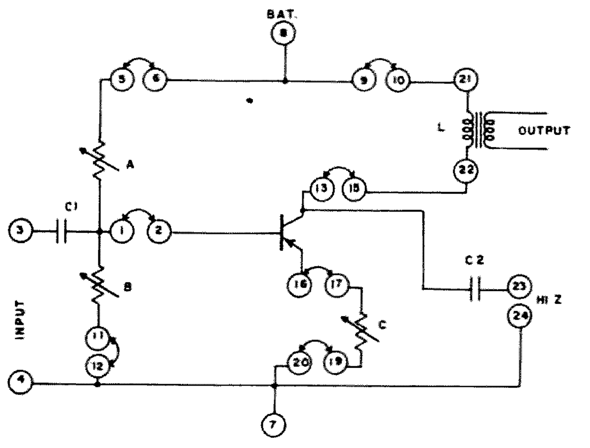


Fig. 5. Still a one stage amplifier, but with a transformer output.

of resistors A and X and also whether a jumper is placed between jacks 3 and 4. Another capacitor can be placed in series with C1 to increase the frequency. Variations of the circuit can be used for both testing and sorting controlled rectifiers and unijunctions.

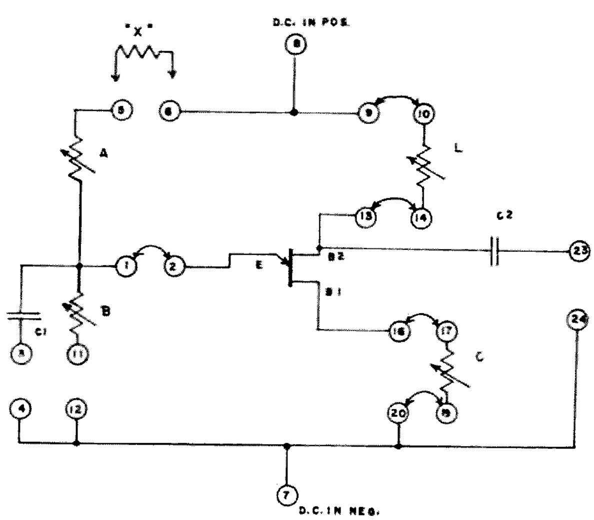


Fig. 6. Unijunctions and even SCRs will operate in this one.

This is a simple tester requiring very few parts, but it is a very handy gadget to have around the shack. However, don't be mislead by its simplicity. Any ingenious ham with a truckload of surplus can expand this device into a monster with flashing lights, and clicking relays — even built-in "self-destruct."

. . .W5WGF

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SSTV Video Analysis of TV Signals

In order to produce pictures of high quality a slow scan camera must be carefully adjusted so that its audio frequency output matches the standards for slow scan picture transmission. Synchronizing pulses are transmitted as bursts of 1200 Hz while video information is transmitted by varying the audio subcarrier from 1500 Hz for black to 2300 Hz for white. Frequency values between these two limits will be reproduced as varying shades of gray.

It is highly desirable to be able to evaluate the video frequency components of a slow scan signal, both for proper adjustment of your own camera and to provide useful reports to other slow scanners on the status of their own camera systems. If the camera subcarrier does not "swing" through the entire video range when both black and pure white values are present in the scene being televised the result will be a picture lacking in contrast that will be either too dark, too light, or just washed out. The wide availability of frequency counters makes it relatively easy to set up the camera for precisely 1200 Hz output during sync pulses but the actual video range obtained during day to day operations can be quite variable when lighting and subject matter are constantly being changed. Constant juggling of monitor contrast and brightness controls can often make the display on your own monitor somewhat subjective in evaluation of video quality since even a poorly adjusted camera can be made to yield passable pictures if you're willing to constantly play with the monitor.

An objective evaluation of the video frequency output of cameras can be had using a spectrum analyser such as the one described by WØLMD (73 SSTV Handbook) but that approach requires the construction of a separate unit strictly for video analysis. The approach to be described here permits real-time line by line analysis of the video excursions of the SSTV signal using the normal station monitor and as few as two additional components—would you believe a switch and a capacitor?

How It Works

Addition of the video analysis mode to the SSTV monitor is based on the fact that many of the commonly used monitors

employ a single sided video discriminator circuit whose output is an amplitude "modulated" signal whose amplitude is directly related to the audio frequency of the signal at any moment in time. Since the incoming SSTV signal has been limited prior to the discriminator, the output of the discriminator is a faithful representation of the frequency excursions of the incoming signal that is independent of the contrast and brightness settings of the monitor. All that is required is to provide a convenient way of displaying the amplitude variations in the output of the discriminator in order to evaluate the slow scan signal. In principle all that is required is to first break the continuity of the video signal at any convenient point so that the monitor trace has a constant brightness and second, to feed a sample of the discriminator output into the monitor vertical amplifier after the normal ramp generator circuit has been disabled. Fig. 1, shows the modifications in my own monitor (*73 Magazine, August 1973, p. 45,*) to accomplish this. One half of a DPDT switch is used to disable the video amplifier (Q3) in the analysis mode. The other side of the switch connects the input of the vertical deflection amplifier to the vertical ramp amplifier in the normal monitor mode but switches to a capacitor connected to the video discriminator (L1) in the analysis mode. In the normal "monitor" position the monitor operates normally while in the "analysis" mode the amplitude variations in the discriminator output are displayed on the vertical axis of the crt. A synched horizontal scan is maintained during analysis. Since the discriminator is tuned to 2300 Hz, the baseline of the display represents this frequency. A portion of the 1200 Hz horizontal sync pulse will appear at the beginning or end of the horizontal trace, depending upon how the monitor is triggered. The peak deflection during the sync pulse provides a 1200 Hz reference level. Black, as 1500 Hz, will have a peak value slightly less than the 1200 Hz reference.

This basic idea can be used in any monitor incorporating a single sided discriminator. This includes the WB8DQT, Macdonald, W9LUO (QST, March 1970) and W4TB circuits (73 SSTV Handbook). Monitors such as the W6MXV with its pulse counting discriminator and the Robot circuit with an "S" shaped discriminator response will not drive the vertical amplifier directly but this idea can be incorporated if an additional 2300 Hz tuned circuit is connected to the input limiter as indicated in Fig. 2. Video continuity may be broken at any convenient point in any of these monitor circuits or the video contrast control may be backed down to minimum gain during analysis to yield a trace of constant brightness. This latter approach is not nearly as convenient as breaking video continuity with the same switch used to route the discriminator output into the vertical deflection amplifiers.

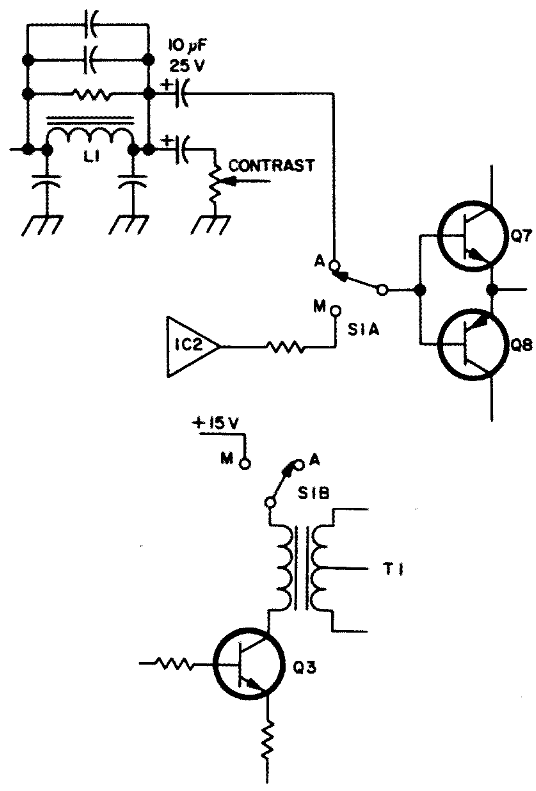

Fig. 1. Modifications of the WB8DQT monitor circuit to incorporate video analysis. S1, a DPDT switch and the 10mf capacitor are the only additional components required. The remaining components illustrated are part of the original circuit and are included to enable the circuit additions to be oriented in relation to the entire circuit. S1A functions to connect the output of the discriminator to the input of the vertical deflection amplifiers while S1B breaks video continuity during analysis. M on the switch terminals indicates the normimal monitor mode while A indicates the new analysis mode.

Using the Video Analysis Mode

Fig. 3 shows drawings of typical video displays from different types of slow scan pictures. Depending upon where your monitor triggers, a portion of the horizontal sync pulse envelope will be visible at the beginning or end of the horizontal trace. The amplitude of the sync pulse envelope provides a 1200 Hz reference. 2300 Hz will fall at or very near the baseline of the display. In order to accurately analyze the video signal the receiver tuning must be accurately set for proper carrier insertion.

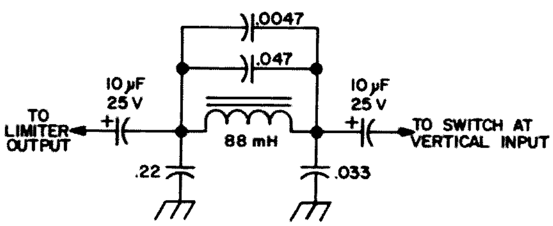

Fig. 2. Addition of a single-sided discriminator to monitors of the W6MXV and Robot type to provide a display signal to the vertical deflection amplifier. The rest of the switching logic would be similar to that illustrated in Fig. 1.

Monitors such as the WB8DQT and W6MXV provide built in tuning indicators for this purpose. The use of an outboard or add-on indicator of the type described by K7YZZ (73 SSTV Handbook) is almost essential for accurate results with monitors which do not incorporate a tuning indicator.

Since noise or QRM falling within the signal passband will also be displayed, critical evaluations can only be made with relatively clean signals. It is also important to realize that there are only a few cases where we should expect a signal to shift completely from 1500 to 2300 Hz. These include station call signs (black letters on a white background and vice versa) and line drawings. If the camera is properly adjusted and the lighting is reasonable, the signal should swing through the entire video range. If it doesn't then some additional adjustment is in order. Normal photographs and well lighted live shots can normally be expected to hit 1500 and 2300 Hz at some point in the picture but cannot be expected to shift this much in every line—it depends on the type of picture being transmitted.

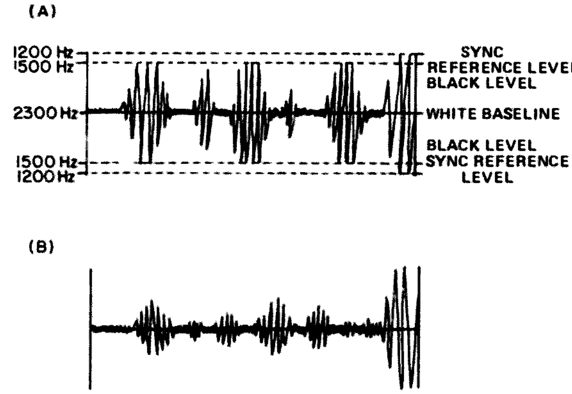

Fig. 3. Typical CRT displays in the video analysis mode. The two fixed reference points are provided by the baseline (2300 Hz) and the peak deflection noted during the horizontal sync pulse interval. (A) shows a display from a well adjusted camera viewing a black and white scene such as block letters on a white background or a line drawing. (B) shows a display where the subcarrier does not swing the full video range but rather is limited to excursions in the white and mid-range gray region. If the picture reproduced here were similar to that in (A) then camera readjustment would be called for. A well adjusted camera on the other hand will produce such a display when scanning a portion of a picture that consists primarily of whites and grays.

Wobbling sync pulses due to multipath propagation will be clearly visible on the display as will any video transients. Highly clipped video will often show some transients in the zone between 1200 and 1500 Hz providing a visual indication of why such signals may often sync erratically, particularly when noisy.

The purpose of the video analysis modification is to provide a useful tool, not to make everyone a video nitpicker. The wide variation in monitor brightness and contrast settings often enable a newcomer to SSTV to view a picture that is actually of very poor quality. The use of video analysis as a tool will enable you to assess the performance of your own camera system as well as providing constructive advice to other operators regarding their own gear.

In summary, this simple modification will enable you to view the line by line video excursions of slow scan signals. The display is fascinating to watch so remember to switch back and view the actual picture every once in a while!

. . . WB8DQT

Build this All-Band VHF Receiver

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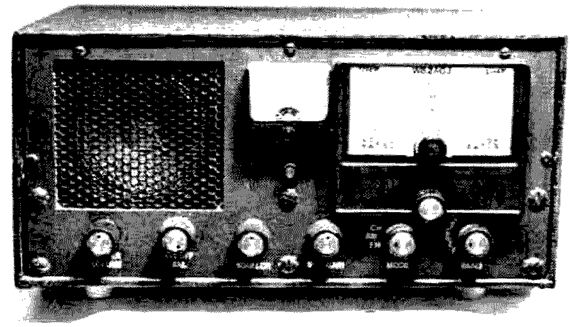


Pity the VHF nut!

Unlike the HF operator whose equipment may span four, five or even six bands in one box, the 50MHz and up man too often finds his shack full of metal enclosures, yards of coax, switches, etc., etc. Even the one VHF band operator now faces the dilemma of the modern age; should his gear be compatible with AM, FM, NBFM, CW or SSB?

I, motivated by a desire to expand his coverage of the bands above 30MHz and prompted by the virtual non-existence of commercially manufactured multi-band, multi-mode VHF gear, nobly embarked upon the lifetime project of a solid-state station for 6 through 3/4m. Since receivers are more difficult than transmitters, and since you can't work what you can't hear anyway, the receiver was done first.

It was deemed necessary that the design criteria for the project follow three objectives. The first was receiver performance characteristics. Sensitivity should be good, noise low, high degree of immunity to cross-modulation, overloading and spurious responses; selectivity should be narrow enough to prevent off-frequency stations from interfering, but wide enough to copy NBFM and drifters.

The second objective was versatility. Since this was to be *the* receiver for all my future endeavors on VHF, it had to work on all popular modes on all the bands with a minimum of controls. Keeping mobile operation in mind, it had to be compact and operate as well on 12V dc as it did on the bench with 110V.

The third consideration was cost. At first I thought of using ICs, since they are compact and inexpensive. However, after experimenting with some 703 rf amps, I decided they were too finicky, too noisy and too difficult to stabilize. The junk box was well stocked with the 50¢ variety of plastic transistors, and, as they lent themselves quite well to experimentation, I began using them.

Based on these factors, the results of the design requirements were a receiver that:

- Covers any two MHz of 28, 50, 144, 220 and 432 with one bandswitch control.
- Receives AM, NBFM, CW and SSB.
- Operates on 117 VAC and/or 12 VDC.
- Measures 28.58cm x 22.86cm x 13.97cm (11¼ x 9 x 5½").
- Looks nice.
- Doesn't break the budget.

Circuitry

The basic receiver is a double-conversion superhet which tunes 28-30MHz. Four converters located above the main chassis permit reception on VHF.

The converters are nearly identical to each other (Figs. 1, 2, 3 & 4), each containing a band-pass filter, two rf amplifiers, a mixer and an oscillator or oscillator chain. Grounded-gate amplifiers were used for the rf stages to afford stability without the need for neutralization. T.I. Tis-34s were used for all stages except the rf amps and mixer at 432, which are Motorola 2N5485s.

10m was chosen as the tunable first i-f to keep down images, and with .2μV sensitivity it's a dandy little band to listen to when the ZLs come in on skip. A single grounded-gate rf stage works well here, once again eliminating neutralization schemes.

The H.F.O. is a Vackar and tunes from

22.5 to 24.5MHz. Tuning is accomplished with variable-capacitance diodes (vvc's) which permit tracking and compactness, see Fig. 5.

The 5.5MHz output of the FET mixer is applied to the second i-f which uses AGC-

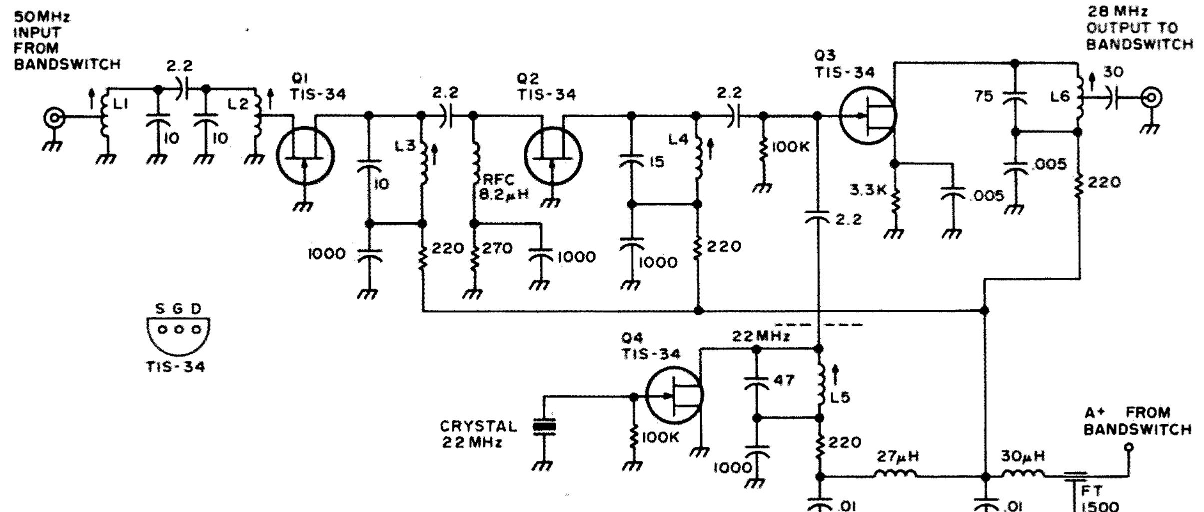


Fig. 1.

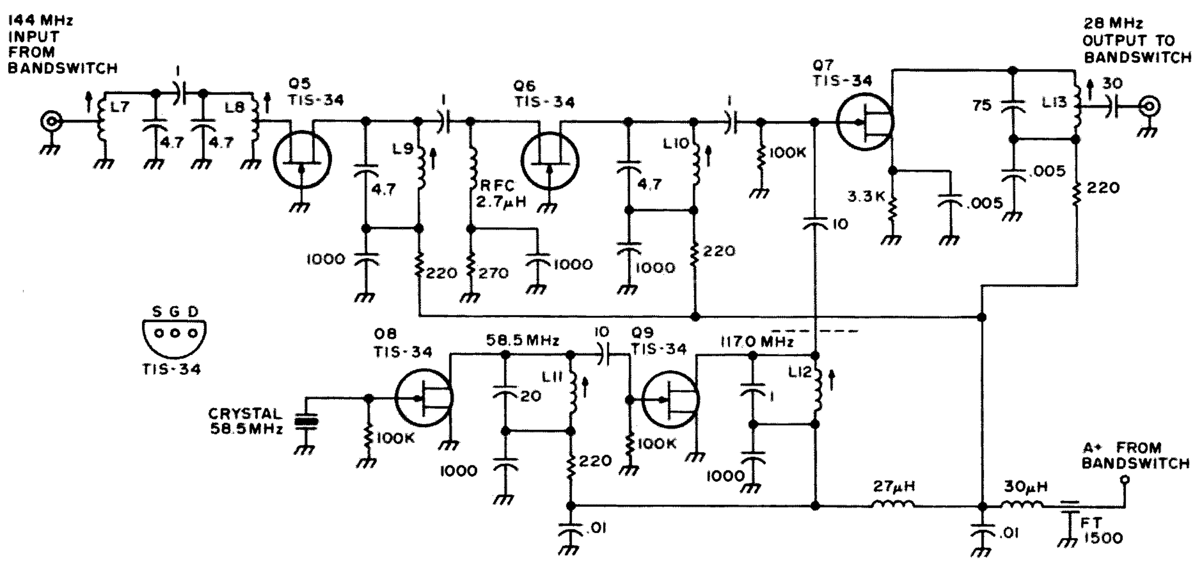


Fig. 2.

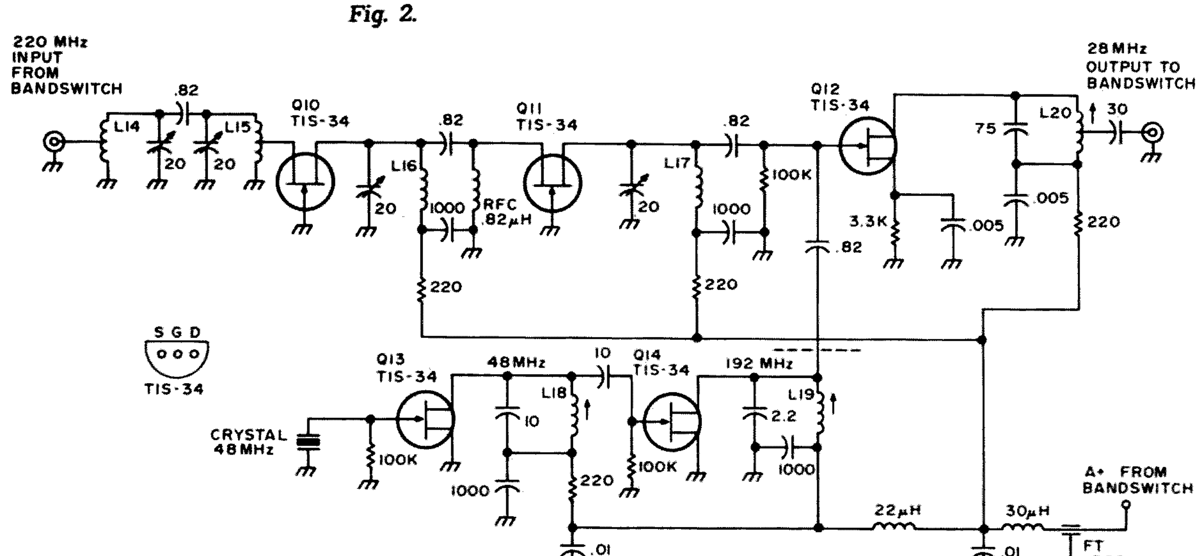


Fig. 3.

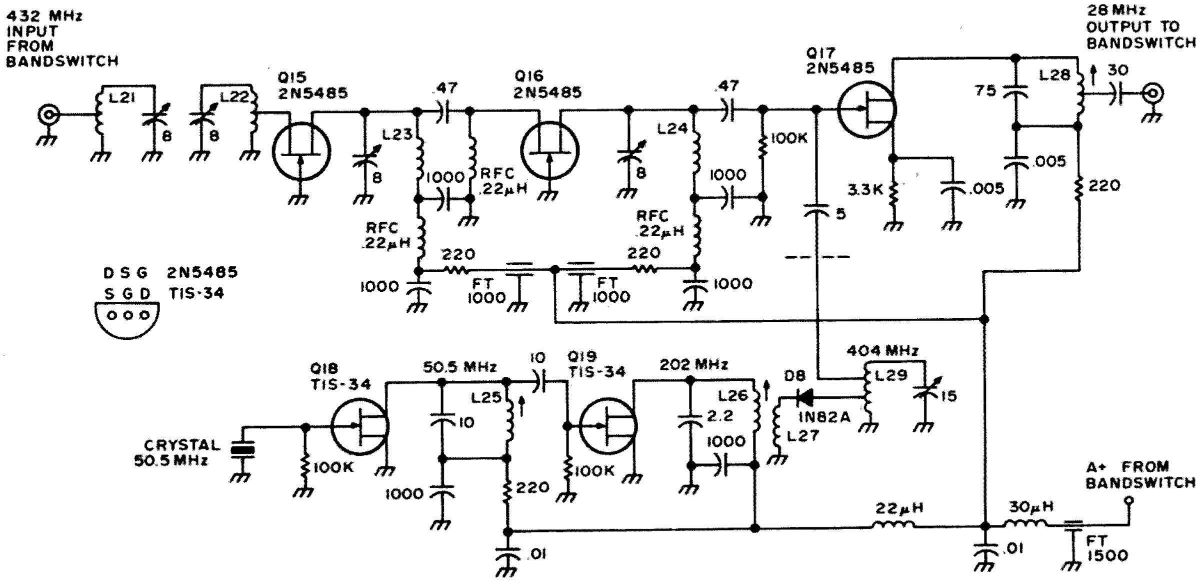


Fig. 4.

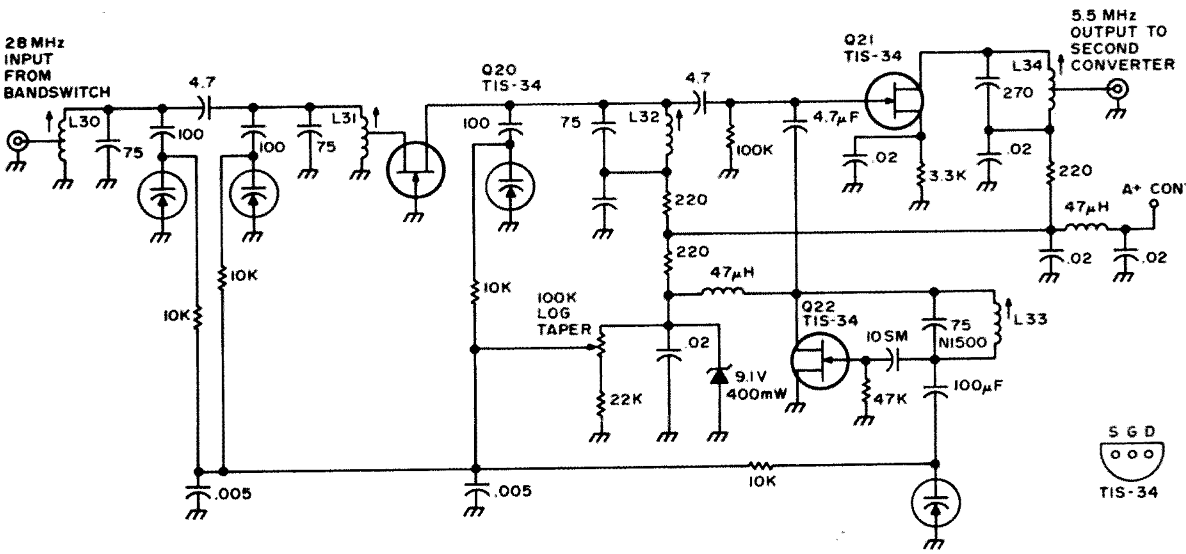


Fig. 5.

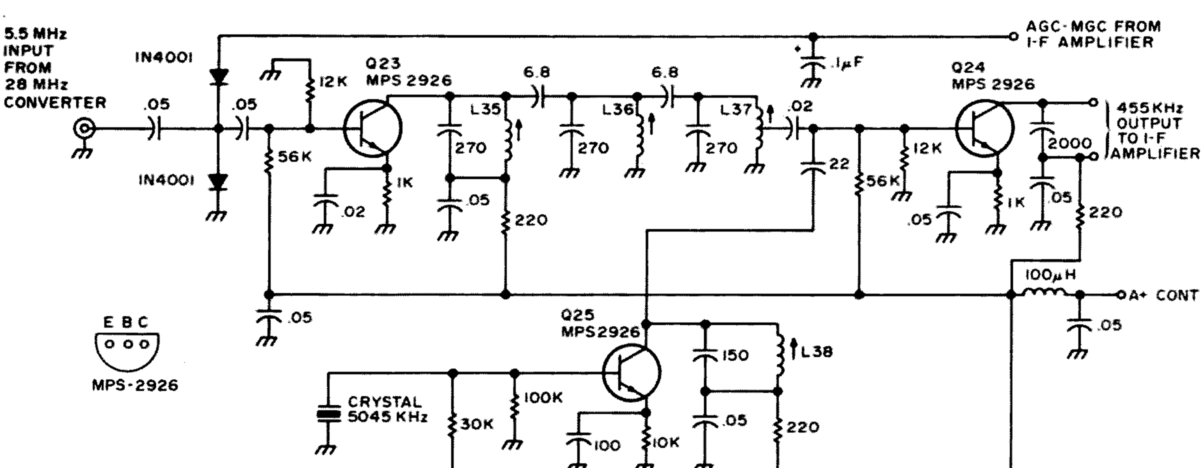


Fig. 6.

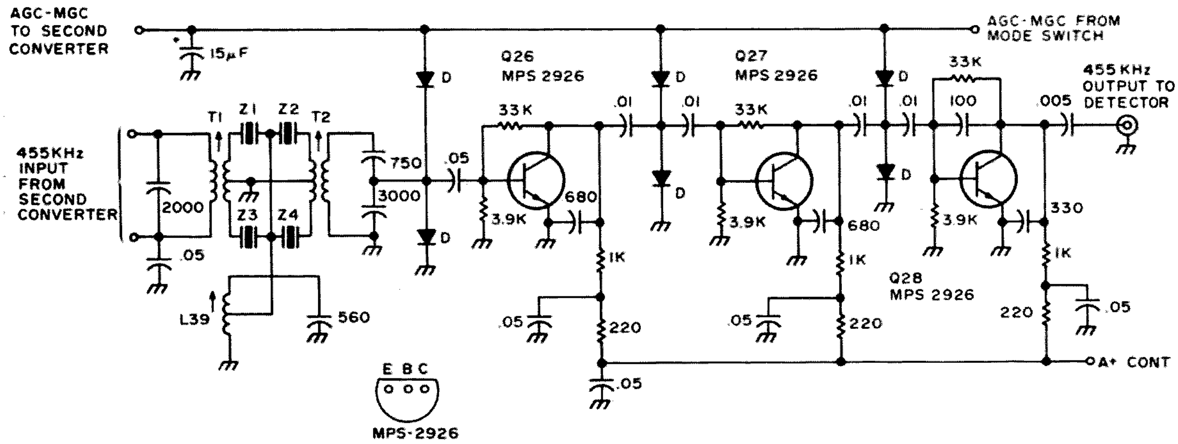


Fig. 7.

MGC controlled amplifier and a triple-tuned filter to reduce the chance of overloading the second mixer, whose output is coupled through a 455 kHz ceramic filter to a three stage high gain amplifier, as shown in Figs. 6 and 7.

The use of silicon rectifiers in the interstage networks of the i-f amplifiers results in an economical, wide range AGC circuit. Transistor Q29, Fig. 8, acts as a limiter on FM; on AM it's a 455kHz amplifier whose rf output is coupled to the IN60 AGC rectifier pair, which is connected as a voltage doubler. The resultant dc is filtered to eliminate amplitude variations caused by speech and biases the AGC amplifier (Q33 & Q34) into conduction; the AGC diodes derive their operating bias from these transistors. With this scheme it is virtually impossible to overload the detector.

The output of Q29 is coupled to the detector via transformer T3. The detector is actually a phase discriminator; however, on AM, CW/SSB, the mode switch connects the circuit as a half-wave rectifier. On CW/SSB, the AGC rectifier is disconnected and the AGC diodes receive their bias from the manual gain control potentiometer; the BFO is energized and connected to T3.

The output of the detector is fed to the squelch and audio stages. The squelch is

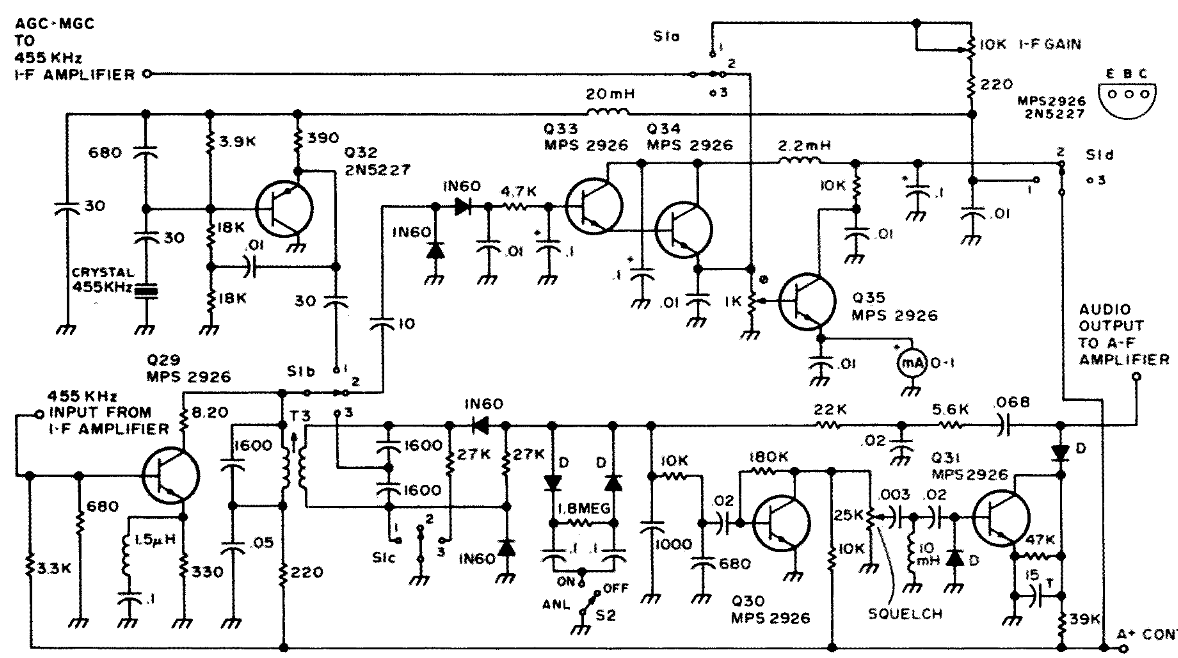


Fig. 8.

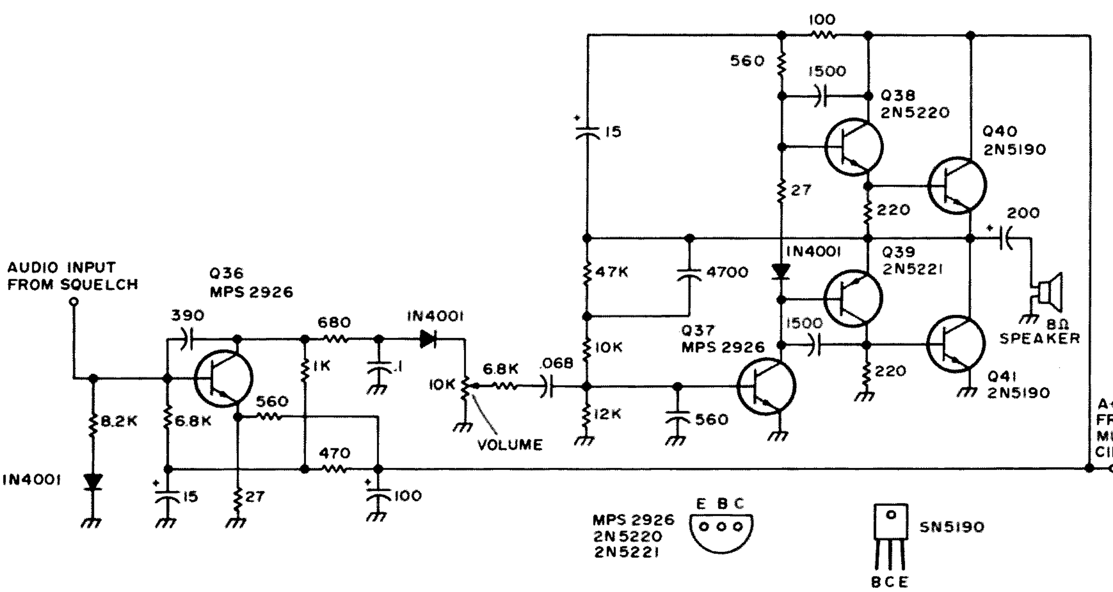


Fig. 9.

noise actuated and contains low-pass and high-pass filters to prevent false triggering by rf and/or audio signals. When noise is present at the detector output, Q31, Fig. 8, biases the first audio transistor, Q36, Fig. 9, out of conduction and mutes the speaker.

The audio amplifier is a quasi-complementary circuit operating at about three watts peak output; it runs class AB and is quite efficient if battery operation is intended.

Power for the receiver is obtained from a simple transformer rectifier filter circuit followed by a Zener referenced Darlington pair, which provides 13.6V at 1A. Muting during transmit is accomplished by grounding the base of Q44 through the 2700Ω resistor, which turns off Q45 and kills the A+ to the audio Amp.

Construction Notes

Modular construction was employed throughout, as it loads itself to ease of testing and troubleshooting. A standard 17.78cm x 27.94cm x 5.08cm (7 x 11 x 2") aluminum chassis was divided into seven compartments by utilizing "egg-crate" construction under the chassis, which effects excellent shielding and contributes to the receivers lack of birdies.

Printed circuit boards measuring 5.72cm x 7.62cm (2¼ x 3") were used for the main receiver. Layout is generally non-critical, but keeping component leads as short as possible is recommended, particularly above 445kHz.

The front panel was cut from heavy gauge aluminum and attached to the main chassis with spacers to allow adequate room for

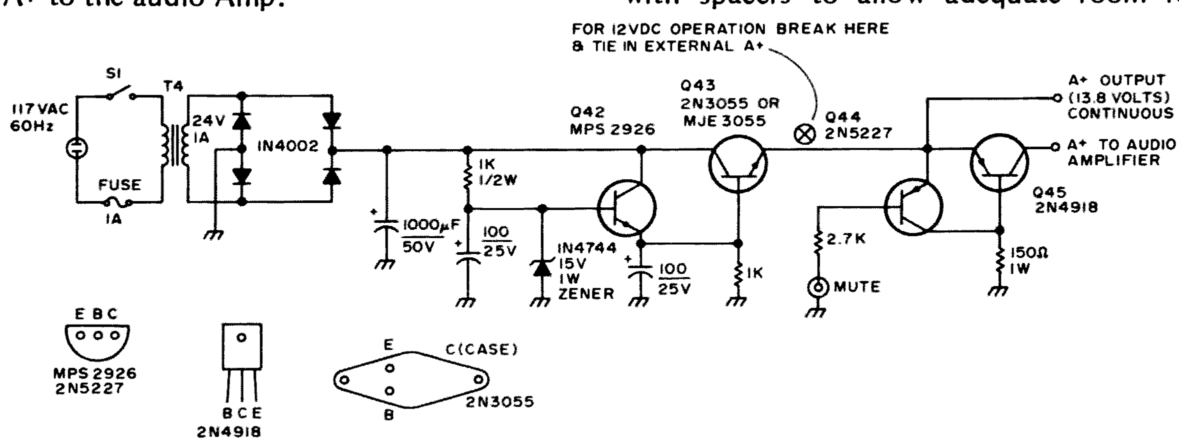
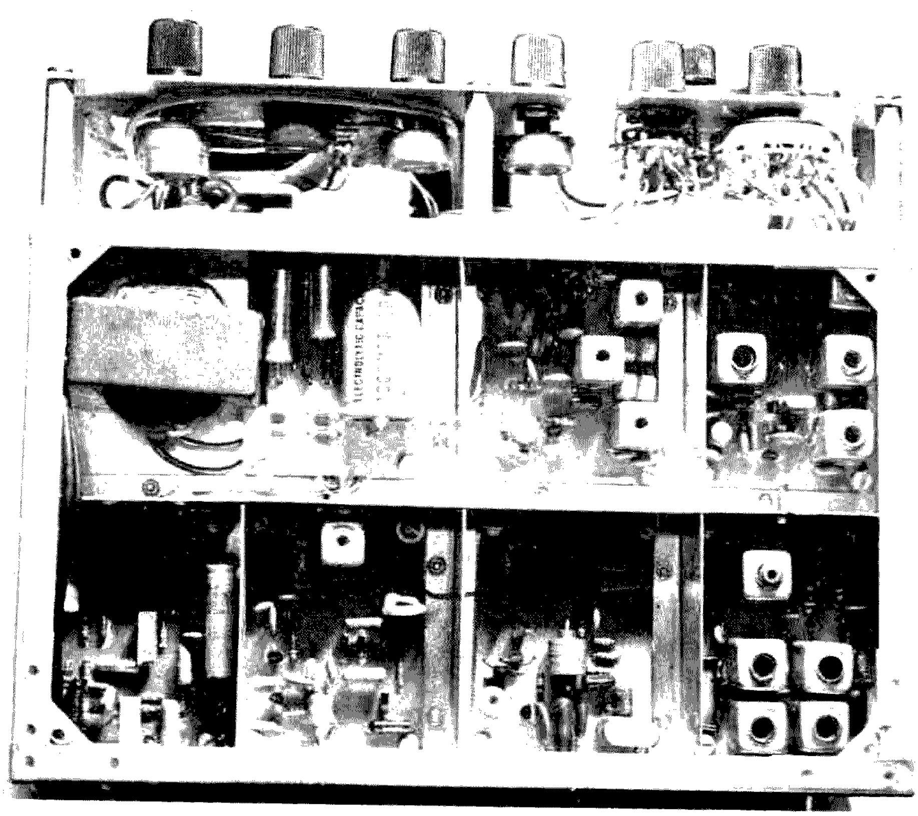


Fig. 10.

50 146 220 432

Power Mute 455 kHz i-f amp. 5.5 MHz conv.



AF amp. Det/Squelch AGC/ANL/BFO 28 MHz conv.

controls.

The VHF converters were built into 13.02cm x 5.72cm x 4.45cm (5-1/8 x 2¼ x 1-3/4") miniboxes and bolted to an aluminum plate, which was mounted above the main chassis. This arrangement permits easy accessability to the converters for alignment, changing crystals, etc.

The converters are fabricated on 11.43cm x 5.08cm (4½ x 2") PC boards; the oscillator chains were placed at one end, the rf stages at the other and the mixers at the center. Shields made of flashing copper separate the oscillator circuits from the remainder of the converter stages, one shield on each side of each board.

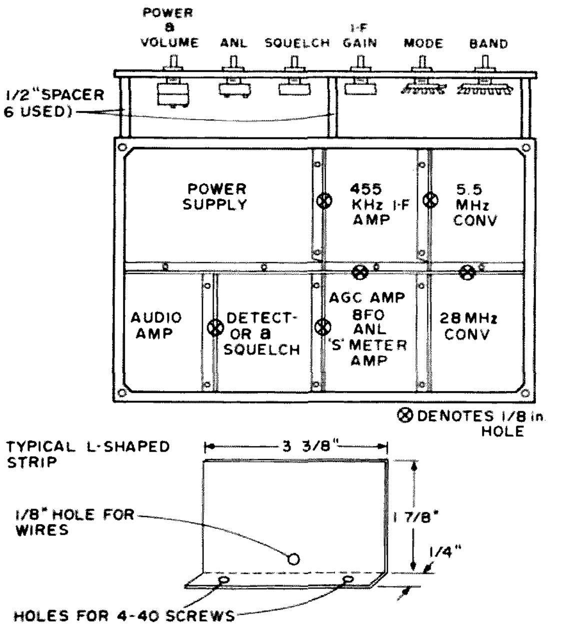


Fig. 11.

On the 432 board it was necessary to add shields between the input and the output (source & drain) of both rf amplifiers to prevent oscillation.

Alignment is not tricky. Start at 455kHz and tune the i-f filter and T3 for maximum S-meter reading in the AM mode. Then tune the 5.5MHz converter by loosely coupling a signal generator to the base of Q23. Next, dip L33 to 23 MHz and connect the signal generator to the antenna input connector of the receiver. With the bandswitch set to 10m tune the generator to 28.5MHz and adjust L33 to receive it. Then peak up the 28MHz stages.

Alignment of the converters is easily done

by first tuning up the oscillator chains with a wavemeter and then peaking all coils or capacitors.

Performance

The sensitivity of the receiver was measured with a calibrated Motorola T-1034C FM signal generator. The 20db quieting sensitivity was as follows:

28 MHz = 0.2μV
50 MHz = 0.1μV
145 MHz = 0.1μV
432 MHz = 0.2μV

The 220MHz sensitivity was measured on an EICO 324 and was estimated to be 0.15μV.

The selectivity is about 10kHz at 60dB which is all that is needed on VHF and is wide enough to follow the drifters (HA-460s and the like) without having to constantly re-tune.

The receiver exhibited no spurious responses, birdies or images on 10, 6 or 2. On 220 and 432 there are some very weak TV images (possibly harmonics); these may, however, be due to my lack of suitable skyhooks on these two bands.

Extensive tests with locals on six have failed to produce cross modulation or overloading.

One word I'd like to add concerning the vvc's in the H.F.O. When the rig was first tested it used a single 25pF variable capacitor to tune and was rock stable. Having the desire to track, the vvc's were installed and a few minutes of warm up drift resulted. If frequency stability is essential, it would be in the best interest of the reader to consider another tuning method, such as ganged capacitors.

The author would like to thank Bud Weisberg K2YOF, for his advice and assistance, as well as encouragement, in getting this bomb together.

Substitutions

The TIS-34s can be replaced by MPF-102s or 2N3819s. 2N5486s in the 432 front end will improve the noise figure slighter. Most of the MPS2926s can be replaced by surplus NPN silicon transistor with an FT above 100 MHz.

. . .WB2AGJ/2

Andrew M. Cohn K4ADL
4823 West Braddock Road
Alexandria VA 22311

Let's Keep Amateur Radio a Secret

From the depths of exotic jungles to the seamy city streets the old familiar cry echoes through the night, "How come we hams never get any recognition?"

To believe the majority, it would appear that public recognition of our happy sport would bring endless benefits. But when architect Mies van der Rohe first stated that "less is more," he could very well have been talking about amateur radio.

Do we really want or need all the recognition we've been beating the drums for? Maybe so, but just for the sake of some academic fun let's take a tongue-in-cheek look at what might happen if amateur radio were to *really* enter the public spotlight, keeping in mind the old proverb: "He who makes waves must face the turning tide."

National Security

As a result of the Watergate Affair, microphones under 13" in length will be strictly controlled by the government. The amateur would submit an application for a microphone permit, together with character references from his local constable, teacher and clergy. In addition, the ARRL would be asked to drop the word "bug" from its glossary of amateur terms.

Civil Rights

It will be noted that amateur radio operators are represented by precious few minorities. The appropriate government agency will require that such minorities be actively recruited into the ranks of the amateur. The ARRL will be pressured to move its headquarters from Newington to Manhattan.

The agency will further require that at least 50% of amateur's on-the-air contacts be carried on with members of a minority group. The FCC will point out that it is quite difficult to determine ethnic background from call letters and will take the initiative to reassign such calls for easy recognition.

These new calls would be similar in a way to current citizens band designations – three letters and four numbers: For example – BLK-2468 or MEX-1357 or JEW-3691 or even NDN-8485. Periodically, the agency would check log books to determine an adequate percentage of ethnic calls are contained therein.

The Civil Liberties Union will of course object to the assigning of ethnic calls, and the Supreme Court will decide such calls are unconstitutional and will recommend that amateurs listen carefully for accents over the air in order to establish contact with minority members. The ARRL will perceptively observe this would be quite difficult using CW, and will offer 78rpm records entitled, "Sending and Receiving Morse Code with an Ethnic Accent of your Choice."

Community Affairs Primetime Broadcasts

Amateur stations will now be included in the FCC's requirement that television sta-

tions devote portions of primetime to local community coverage. Thus, for a two hour primetime period each evening amateurs will be required to limit their contacts to other hams within their community. Citizens band operators will be politely asked to avoid working skip stations during this period.

The Spectrum Crisis

The shrinking availability of frequencies will cause difficulties for the amateur. Rationing will go into effect whereby each amateur receives coupons permitting so many hours of operating time each month. Coupons may be accumulated for long periods of operation such as DXpeditions.

A share-the-frequency program will be adopted similar to the splendid system now working on 40m phone wherein U.S. amateurs exist in perfect harmony with foreign broadcast stations.

Nets will be heartily encouraged to bring together the greatest number of amateurs on one frequency. Citations and fines for malicious interference will be dropped as this practice rarely takes place on a clear frequency.

Manufacturers of tin cans and twine will curiously note receipt of government grants for research and development.

Unemployment

Hard core unemployed persons will be recruited to work in electronic manufacturing assembly lines. Thus, kits will no longer be available for the amateur as all equipment must be factory-built to create these additional positions. On the bright side, however, the resulting product might be of such poor quality as to require the amateur to completely rebuild the item from scratch.

Highway Safety

Safety councils will begin to look into amateur mobile operation and its hazards, particularly the dangers of working a touchtone pad while driving. Recognizing the value of autopatch, the councils will turn to the telephone companies for an adequate solution.

Already we have word of a new technology under way to eliminate the problem, and particularly to eliminate the complicated, wasteful technology now in existence.

Instead of touchtone pads and the cumbersome associated electronics, telephone companies will hire multitudes of young ladies to personally handle calls. One would simply speak the desired number into the microphone and a pretty operator would patch the call through: Although the precise wording hasn't yet been decided upon, these ladies might ask, to determine your number, something like, "Number Plee-uze!"

Pollution: Visual and Electromagnetic

The visual aspects of towers, beams and mountain top repeaters will now be dealt with by the government's Environmental Protection Agency in its fight to rid our nation of visual pollution.

The policy of installing underground power and telephone cables will be extended to the amateur service. EPA will require antennas of all types to be installed beneath the ground. FCC will correctly note that such action may limit the effectiveness of communications and will recommend the establishment of a subcommittee to determine the feasibility of forming a commission to study suitable alternatives.

Recognizing that an underground antenna is far superior to none at all, EPA will move quickly to the problem of electromagnetic pollution.

First, electronic manufacturers will be required to install devices on all transmitting equipment to drastically reduce the power output. Amateurs will be warned not to remove these anti-pollution devices and will be required to submit their equipment for inspection on a regular basis.

The task of inspection will be given to local gas stations already established as state vehicle inspection agencies. Service station operators will welcome the responsibility as they will have precious little to keep busy with otherwise. A sticker will be placed on the transmitter with the expiration date noted thereon. Transmitters not passing the test will be given a rejection sticker requiring the owner to re-install the anti-pollution device within ten days or else forfeit the right to transmit.

The second step in the program to reduce the quantity of electromagnetic radiation will take the form of "contact pools."

Instead of each amateur operating his own station, groups of amateurs will be transported (by car pool, naturally) to the home of a particular ham. There, each will be given his turn at the equipment for a specified time. Each amateur will entertain the others in his home on a rotating basis.

The annual Field Day will also take on a new look. Rather than each club operating its own station, all clubs within a city will band together (no pun intended) and operate as one station, using, of course, but one station. *QST* will then list final scores by cities rather than by stations.

Financial Security – A Happy Note

First you've heard the bad news and now for the good news. I'm not too sure what this has to do with any of the above, but Japanese ham equipment has now been added to the list of great investments.

For example if you were to purchase a TR-22 now at age 20, by the time you retire at age 65 you could sell the unit and live quite comfortably.

. . . K4ADL

SOCIAL EVENTS

GREENBELT, MD – FEB 3

FM Minifest at the Goddard Space Flight Center. Speaker, movie, prizes, free refreshments. Time: 1PM.

OAK PARK, MICH JAN. 12

Oak Park Amateur Radio Club's sixth annual swap and shop at the Frost Junior High School Cafetorium, 23261 Scotia, Oak Park, Michigan.

SOUTHFIELD MICH JAN 19

Sponsored by the Southfield Amateur Radio Club, this is the largest Swap & Shop in Michigan. Southfield High School, Ten Mile and Lahser Rds., Southfield, Michigan. Tickets are $1.50 each. For info on tickets or tables write to Robert Younker, 24675 Lahser Rd., Southfield, Michigan 48075. Attn: Chas. A. Tyrrell.

WEST ALLIS, WISC. – JAN 25

The West Allis Midwinter Swapfest is Saturday, January 25, 1975 at Waukesha County Exposition Center located on Waukesha County Trunk Highway FT, Southwest of Waukesha County Airport. Doors open at 8 A.M. Refreshments, breakfast and lunch, available. Talk-in on 146.94. Rain or shine. Tickets $1 advance; $1.50 at the door. For details write WA9KRF, 4582 South Ahmedi Avenue, Milwaukee, Wisconsin 53207.

MANSFIELD, OH FEB 7

The Intercity Radio Club annual auction will be held Friday, February 7th at the Naval Reserve Training Center at Ashland Road in Mansfield, Ohio. Doors open at 6:00 P.M. Look, swap, buy at 7:30 P.M. No flea fees nor commissions charged. Auction at 8:00 P.M. Eats. Donation of two dollars at the door. For more information write K8JPF, 120 Homewood, Mansfield, Ohio 44906.

WHEATON, ILL – FEB 9

The Wheaton Community Radio Amateurs announce their 13th annual mid-winter hamfest on Sunday, February 9th at the DuPage County Fairgrounds, Wheaton, Illinois. Hours are 8 A.M. to 5 P.M. Tickets are $1.50 advance; $2.00 at the door. Free coffee and donuts 9:00 to 9:00 A.M. For information and advance tickets send a stamped self addressed envelope to L.O. Shaw, W9OKI, 433 S. Villa Ave., Villa Park, Ill. 60181.

W2NSD from Page 2

power increases – stiff opposition to Hiran try for grab of 450 hamband by Big Oil – Mexico says no Canadians can get a ticket – CARF election results – latest FCC repeater and Gettysburg report – new rule interpretation re control of repeaters – CBers get shaft in Detroit, in Jacksonville, in Des Moines and bad PR a lot of places.

Industry news includes the new Midland repeater program – the results of the Genave move to direct sales – the exciting growth of 160m – the reaction to the QST November editorial by industry – restraint of trade complaint lodged against QST – Crawford Amateur Radio Society vs CQ Magazine.

Add to that some late club events – auctions – QSO parties – plus a Godbout ad for some of the newest and most fantastic computer ICs... the first place ever advertised! It is possible to build an $8000-type computer with these new and incredible chips.

Hotline is available – mailed every other Friday by first class mail (some subscribers have been getting it by Saturday!) – the price is only $8 per year. Compare this to the similar, but much smaller report, done by typewriter, with about one half to one third the news, and costing $12 per year.

Readers with hot news of interest to really active hams are encouraged to send it to Hotline, 73 Magazine, Peterborough NH 03458. News of emergency operations, disasters, special club events, QSO parties, contests, certificates, newspaper clippings about amateur radio or CB, industry news, new products, FCC petitions, DX news, things like that...please send to Hotline.

.. WAYNE

Voxpoop

W2AOO WINS $50

The winner of the VOX POOP award for November is W2AOO with his Digital Wind Indicator. Runners up were K2OAW's Counter Update and WA0ABI's Basic Bridge. W2AOO receives $50 as a prize. Send in your vote for your favorite article this month and encourage the author to write again.

GRR GRRREEN

APPRECIATION...

Not a few of the 73 readers accept 73 for what it really is – a hobby magazine for a bunch of fellows with relatively similar interests, without a lot of pretentions. They realize that the pages of 73 are wide open to anyone with ideas or something to say and that it doesn't have to filter through a board of directors, general manager, and a whole hierarchy before it can get into print. In fact, no one on the 73 staff has to even agree with the idea for it to get into print.

The articles are written entirely by the readers, not by engineers in a $100,000 HQ lab, which means that most of our projects work, even for the fellow with a test lab consisting of little more than a volt-ohm-meter.

One result of this approach to publishing the magazine is that a great many of the readers have feelings about 73...some love it, some hate it, but few are uncommitted. Much of the negative reaction comes from people who have a need for an authority to look up to so they won't have the responsibility of actually doing anything themselves. They get furious when 73 points out that there are some very good reasons for getting after the FCC...they prefer to let the ARRL do this and not to be bothered...after all, it's just a hobby. It is even worse when it turns out that the 73 readers were the ones which brought about some major changes for the better.

The 73 readers who enjoy the magazine and appreciate the openness of the pages to them act a lot more like good friends than paying customers for a product in that they write personal and friendly letters... even if they happen to disagree about an editorial or an article. They keep an eye on the papers and other magazines and send in clippings that they think will be of interest...clippings about amateur radio . . . about UFOs . . . CB . . . gravity experiments...all sorts of oddball things that they know will interest me...and a lot of other readers. These clippings are really appreciated for it gives me the feeling that I have eyes almost everywhere.

It is trite to say that this is your magazine. . .but this is true for it is written by you, the reader, with some seasoning thrown in from my imagination. . .and a good deal of that is, again, just reader feedback.

Let's suppose that you have a typewriter just sort of sitting around getting dusty and you get the feeling that it would be fun to see your name up in lights. . .well, in print. You sit down at the typewriter, put in the paper, and then you stare at it. And stare. The mind goes blank. You get up in disgust, rip out the paper, and go back to the hamshack a defeated writer.

Ridiculous. There are an infinite number of things to write about. You may be an FM'er who gets around on the repeaters a lot, so how about a short article on which repeaters are the most friendly for visitors, which are abrupt with transcients, which channels are the best for an amateur who may be going through your area.

Or perhaps you know an amateur who really goes out of his way to help amateur radio. . .how about an article about him, with some pictures? Not only will you reward him for his interest and work, but your article will certainly encourage others to be inspired to get busy and do something.

Perhaps you are into contests. . .so how about an article suggesting improvements in contest rules or one encouraging others to join you in your fun in working the contests? Certificates? Very little is written about them and a lot of amateurs would be interested in getting into certificate collecting if more were written about that part of the hobby. The fact is that just about every amateur is an "expert" on something or has an interesting story to tell.

The Japanese ham magazines are filled with pictures and stories of club activity. . .and they are interesting. Our clubs get into lots of fascinating projects, but not one single person in the club takes the interest to write up the adventure and get it published!

I'll say it again – 73 is *your* magazine – it is written by you – so use it to help amateur radio progress. . .to interest others. . .to give everyone more fun. And keep those letters and clippings coming in.

ARE SHARED REPEATER CHANNELS A POSSIBILITY?

As repeater coordinating committees find themselves running out of channels to allocate, they are faced with the problems of what to suggest to new repeater groups which are looking for frequencies. Do they tell them that everything is taken on two meters and the new repeater must go up on 220 MHz or 450 MHz?

A talk with some of the coordinators and a listening check in some of the major areas where this has developed into a problem has brought out some factors which should be considered. The fact is that many of the repeaters are being used very little and it is unfair to other groups wanting channels to tie up pairs of frequencies for such limited use.

A survey of repeater activity in several areas seems to indicate that the overall number of repeater users has not noticeably increased during the last year or so. It appears that larger groups have in many cases broken up into smaller groups and set up their own repeaters. It does not appear that the smaller groups have been growing much once they have been established.

Commercial repeater users have had to work out systems of sharing channels and it appears that something like this might be a possibility for amateur repeater groups as an answer to the squeeze for spectrum space.

Take New York for instance – there are repeaters allocated to every known channel and splinter channel there – yet listening checks have shown that there are seldom more than six or eight repeaters in use, even during the heaviest usage hours of the day. If some system for channel sharing could be worked out it would permit more repeaters to be set up without any substantial sacrifice on the part of the present users in the area.

Time sharing of repeater channels will call for a basic change of attitude on the part of some groups. Where in the past the tendency has been to get involved in repeater wars and harrassment, groups will have to think in terms of cooperation and consideration. Can this change be made? Considering the volatile and infantile nature of some of the instigators of past repeater wars, one wonders if anything really is possible.

73 Magazine will welcome ideas along this line – and any information about cooperating repeaters which have worked out a channel sharing system.

UGLY RUMORS UNTRUE

Rumor #1: the ham business is going down hill. Bunk! Some ham gear isn't moving well, of course. . . but most is in such short supply that dealers are crying for deliveries and manufacturers are fighting the battle of parts and labor, not sales. Sure, a bunch of dealers went out of the business when "incentive licensing" almost stopped sales of ham gear for a few years. . .but since those dark days there have been more and more ham dealers opening up and doing very well. Yes, National went bankrupt, but. . .that was from taking a bath on military contracts, not ham gear. . . and they are getting back into business again. . .watch for them.

Rumor #2: Hallicrafters is out of the ham business. Bunk! They changed owners again and they have some new designs in the works so watch for a new and expanded Hallicrafters line.

Rumor #3: Swan is going out of the ham business. Bunk! Jerry Ringer of Cubic, the parent company for Swan and Siliconix (CB arm of Swan), says not just no, but hell no.

Rumor #4: SBE is giving up the ham business. Bunk, says president Dave Thompson and Adman Bud Bane, new gear is in engineering for 1975.

Rumor #5: FM gear isn't selling like it used to. Bunk, again! It is a fact that the 22-up channel rigs are the big sellers now that almost every area of the country is blooming with new repeaters. It looks like the prediction of 2000 U.S. repeaters by the end of the year will be true. Icom probably could sell several times as many rigs if they could get them into the U.S. fast enough. Clegg is going in high gear. The new Multi-2000 and KDK-144 rigs, just announced, are already back ordered. HT's are selling unbelievably. . .it appears that virtually every FMer wants to have an HT on his belt or in his hand at hamfests and available for emergencies.

Rumor #6: Crystals aren't selling much now that there are so many synthesized two meter rigs. The shortage of these synthesized rigs and the lower initial cost of the crystal rigs has kept sales of the 22-up channel transceivers high. . .IC-22 – IC-21 – TR-72 – etc. The rigs end up costing about the same as the synthesized jobs, but the cost is spread out since crystals are bought a few at a time. Crystal manufacturers report that sales are as heavy this year as last and the problem is still in trying to keep up with the orders.

Rumor #7: Hams are not buying gear because they are worried about inflation. Utter rot. The fact is the reverse. . .most amateurs realize that now is the best time to buy gear since prices can do nothing but go up. The worst possible thing to hold on to is cash, the *only* thing that isn't going to inflate. The tighter you hold money, the more it shrinks.

Rumor#8: The antenna companies are in trouble. Bunk – in part. One of the bigger companies has been having

financial difficulties, but the rest seem to be doing okay. The only major gripe is not sales, but getting aluminum. . .and that is getting more and more difficult. KLM reports antenna sales booming along. Wilson's antennas are too.

The only soft spots in sales seem to be with those rigs which are well behind the state of the art. VHF amplifiers are selling very well. Surplus test equipment is doing fantastically. . .Tucker Electronics reports that better quality test gear is leading in sales. . .their Teco division reports ham gear doing very well. . .Yaesu leading. Atlas, in new headquarters, is working to cut down the back log of orders. Dentron reports 160m sales are extraordinary. . .that interest in 160 is growing more rapidly than they can handle. Interest in the new Heath rig. . .the SB-104 featured in the full color ads in the November issues of ham rags. . .is out of sight.

Watch for some equipment for the 160 kHz band, by the way. One of the major low band manufacturers is preparing gear for this band where no license is needed. . .160-190 kHz. . .one watt. . .50 foot antennas. DX up to 100 miles seems possible on this one and it may turn into a major experimenters delight.

One night while driving back to New Hampshire from New York, where I'd been for a business meeting, I was making my way through a blizzard, stopping every few miles to scrape the ice off my windshield so the wipers could get a grip. It was terrible conditions and I blessed my two meter rig for the security it gave my mind.

I'd started without dinner and as the night grew later I worried that I would run out of places to buy a snack. Somewhere along in Connecticut I suddenly came across an exit on the Thruway. Visibility was a minimum so I didn't know just where I was. Not far from the exit was a big shopping center with a discount house/supermarket. I went in and found a fantastic bakery department with incredibly delicious cookies and pastries.

Back on the thruway I was quickly involved in fighting the storm, workmy way through a couple of jacknifed trucks at New Haven, and talking with the wonderful group on the 01-61 repeater there. The more I ate of those cookies the more I wanted to stop back on the next trip and load up — they were the best pastries I'd ever eaten! I wanted to bring back a big bag of them and freeze them so my family could enjoy them for a long time. I almost always bring back a big bag of Bialy's from New York and freeze them for extended use — if you haven't tried Bialy's, then you've missed something very special.

On the next trip to New York I tried to find the shopping center and that bakery. It seemed to have disappeared. I tried every exit below New Haven and couldn't find anything. One of these days — perhaps the next time I'm driving through a blizzard — I'll come across that phantom supermarket.

WHY AMATEURS
DON'T BUILD

Through letters, contacts on the air, and talking at club meetings I hear the ever present chorus from old timers that hams are not building anymore — certainly not like they used to. And what a shame, for building used to be one of the most exciting and important aspects of the hobby. The newcomers just can't appreciate amateur radio the way old timers did when they buy all their equipment instead of building it.

Time after time I've tried to point out to old timers that nothing could be further from the truth. . .that newcomers are building a lot more than the old timers ever did. . .just look at the enormous number of pages of ads for parts in 73 Magazine and compare that with parts ads in the glorious building days of the 1930's. . .there is no comparison.

As my grandmother used to say, "A man convinced against his will is of the same opinion still."

Virginia was reporting on a talk she had had with an old timer. . .he asked if we couldn't just put in an occasional tube article for him and other old timers. . .that he didn't understand solid state stuff. . .and suddenly there it was! Flash! For the first time I realized what was causing all this difficulty. I realized why old timers are so completely convinced that hams are not building these days.

My first reaction was to marvel at my own denseness. . .to wonder why I hadn't realized this a long time ago and done something about it. The whole thing was so obvious once I thought about it.

For years I have known that the readers of ham magazines like construction projects more than anything else. I also realized that they enjoyed reading these articles more as fiction than for the actual building. A hundred thousand amateurs would read a particularly good article and fantasize building the unit described. . .while perhaps a couple hundred or so would actually build the project. . .and fifty more would use it with substantial modifications and improvements as part of something else.

Old timers spent years building tube circuits in their imagination and enjoying it. Then came transistors and the circuits all changed completely and no longer made sense. Oscillators no longer looked like oscillators. Mixers looked like Chinese writing. They couldn't build anymore. For a while they made do by reading QST, which kept plugging away with tube circuits through several years of transistor development. Eventually younger voices finally were able to make themselves heard, even in Newington, and QST reluctantly went solid state. It took a lot of pressure to get the old men at HQ to change, but they made it. This left old timers with no magazines publishing construction projects they could understand. . .and they translated this great and sad loss into a general feeling that no one was building anymore.

The old timers took heart rather late in the 60's when George Grammar wrote in QST that the reason QST published so few solid state articles was that amateurs were tube oriented and that he personally didn't believe that transistors were going to last, considering all of their serious drawbacks. Tubes would always be with us.

George was right in one way. . .transistors didn't last very long. After only a few years they got packed into little chips and appeared as ICs, further upsetting old timers who now found themselves two steps behind instead of just one.

Recognizing the problem is important for its solution, so I'm glad that this flash of inspiration came along as it will help us to pull things together. Being an old timer myself I can empathize. I feel a lot more comfortable with tubes and love to get together with other fogies and reminisce over 30's, 19's, 76's with slotted bases, and things like that. And remember the 15E. . .what a fantastic little tube that was!

One obvious move to help the situation will be for 73 to start publishing a few tube circuits. These will be good for old timers and give them comfort. They will also be good for a lot of newcomers who need inexpensive projects. . .and there are a whole lot of junk boxes bristling with old tubes. Another approach will be to try and publish some basic articles on modern solid state technology to help us old timers get oriented so we can at least read modern construction projects and follow them.

The next time you hear someone complaining about hams not building like they used to, see if the shoe doesn't fit.

. . . Wayne

Submitted by:
Michael Kresila
Box 57
Marion OH 43302

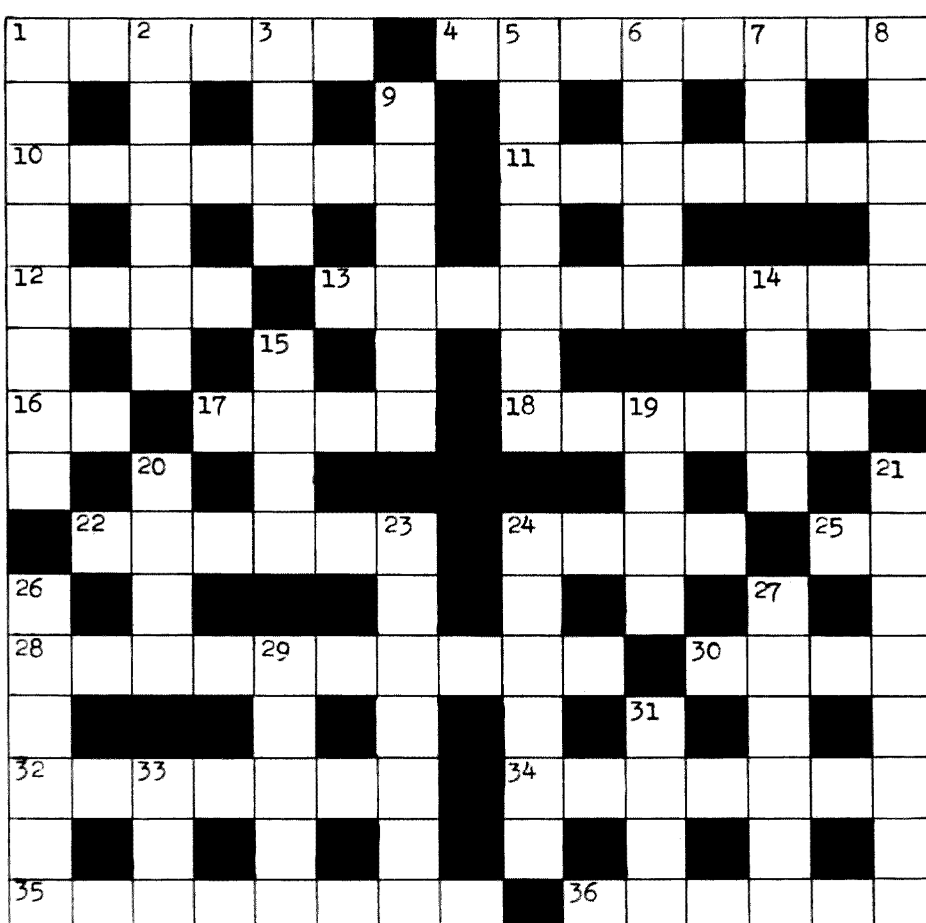
PUZZLE

ACROSS

1. Unit of electric current flow.
4. A sinusoidal wave having a frequency that is an integral multiple of the fundamental frequency.
10. A clip used to make easy connection, located at the top of some radio tubes. (2 words)
11. Elevated conductor for sending or receiving radio waves.
12. The measure of the duration of an event.
13. A two-layer device that, above a certain reverse voltage has a sudden rise in current. (2 words)
16. Outside diameter. Abbr.
17. A sound wave capable of exciting an auditory sensation having pitch.
18. In a circle, the angle included within an arc equal to the radius of the circle.
22. Interference to radio reception due to electrical discharges.
24. Having a level surface.
25. Power line. Abbr.
28. An instrument for indicating the condition of vacuum tubes. (2 words)
30. Also called a diaphragm.
32. A continuous-wave, low-frequency navigation system that provides information over long distances.
34. One of the end sections of a transistor.
35. A term sometimes applied to the mid-range speaker in a three-way speaker system.
36. A unit of force, in the mksa system.

DOWN

1. A unit of measurement of a wavelength of light and other radiation.
2. Solids whose bases or ends are similar polygons and whose sides are parallelograms.
3. A metal panel upon which is mounted radio equipment.
4. Also known as "hams."
6. Reduced in volume, deadening a sound.
7. Girls nickname.
8. The cavity formed in the positive carbon electrode of an electric arc.
9. The place or range of action.
14. Elliptical.
15. Unit of electromotive force or pressure.
19. A means for indicating the value to which a control knob has been set.
20. Any short projection.
21. A tube in which the speed rather than the number of electrons is controlled by the input signal.
23. A two-stage triode amplifier.
24. A wire or set of wires supplying energy from a source to a load.
26. Remains upright.
27. A type of oscillator using electron coupling to the output circuit, popular with amateur radio operators.
29. To move the lever of a switch.
31. That quality of a thing which determines how much space it occupies.
33. Voice-frequency unit. Abbr.



SOLUTION ON PAGE 122

Caveat Emptor from Page 19

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send SASE showing make and model number. Joseph C. Crockett K3KUL, 762 S. Gulph Road, King of Prussia PA 19406.

SELL: ROBOT SSTV Models 80 Camera and 70 Monitor. Original cartons and instruction books. Excellent condition. $500.00. Gordon Buckner, WØVZK, Box 721, Marshall, Missouri 65340.

SELL SB301 (with all filters) – SB401 $500 including set spare tubes. Also collect atlases, road maps, etc. WA6CPP, #10, Wallace, California 95254.

WANTED: Following parts of AN/TNH-2 Tape Recorder – AM-1634/TNH-2B or AM-1251/TNH. State condition and price. Richard Leary, 9380 Larkspur Drive, Westminster, CA 92683.

HEATH SB-301, superb condition, SSB/CW Filters – $170; 2-meter Gonset Comm-IIB – $65; TCS-5 Receiver W/AC supply 1.5-12MC – $25, John WA7LHG, 2814 N. Park Ave., Tucson, AZ 85719. (602) 623-4609.

BNC: Tee $1. Elbows 75¢. UG492A/U bulkhead double receptacles 25¢. UG290/U receptacles 25¢. 12" jumpers BNC plugs both ends 50¢. 3' jumpers $1. UG260B/U plugs, cutoffs, 25¢. Various N and MB connectors and adapters. SASE for detailed list. Add 50¢ per order postage. Alan Douglas, Box 225, Pocasset, MA. 02559.

NEARSIGHTED? Improve your sight, whether nearsighted or farsighted, with tested exercises, sound theory. Hardbound. Ham discount $7.00 Ppd. M. Windolph, 3140 Meramec, St. Louis MO. 63118.

HAMMARLUND HQ-170AC-VHF receiver, 160M to 2M, Clock and IF noise immunizer installed $275.00. WA3OBW (215) H02-9293, Ralph Conner, 149 Gladstone St. Phila., PA. 19148.

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SOLUTION TO PUZZLE, p. 120

1 A	M	2 P	E	3 R	E		4 H	5 A	R	6 M	O	7 N	I	8 C
N		R		A		9 S		M		U		A		R
10 G	R	I	D	C	A	P		11 A	N	T	E	N	N	A
S		S		K		H		T		E				T
12 T	I	M	E		13 Z	E	N	E	R	D	I	14 O	D	E
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M		20 S		L						I		L		21 K
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26 S		U				A		E		L		27 T		Y
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35 S	Q	U	A	W	K	E	R		36 N	E	W	T	O	N

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J.H. Nelson

Good (open) Fair (□) Poor (O)

January — 1975

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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$\boxed{5}$	$\boxed{6}$	7	8	$\boxed{9}$	$\boxed{10}$	11
12	13	$\boxed{14}$	$\boxed{15}$	$\boxed{16}$	17	18
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26	27	$\boxed{28}$	$\boxed{29}$	30	$\boxed{31}$	

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7	7	7	3	3	3	3	3	7	7A	14	14
ARGENTINA	7	7B	7	7	7	7	14	14	14	14	14A	14
AUSTRALIA	14	7B	7B	7B	7	7	3B	7	14	14B	14	14
CANAL ZONE	7	7	7	7	7	7	7	14	14A	14A	14	14
ENGLAND	7	3	3	3	3	3	7	14A	14	14	7	7
HAWAII	14	7B	7	3	3	3	3	3	7B	14	14A	14A
INDIA	3	3	3B	3B	3B	3B	7	14	7B	7B	7B	7
JAPAN	14	7B	7B	3	3	3	3	3	3B	3B	7	7A
MEXICO	14	7	7	7	7	7	7	14	14	14	14A	14
PHILIPPINES	7A	7B	7B	3B	3B	3	3	7	7	7B	3B	3B
PUERTO RICO	7	3	3	3	3	3	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	3A	7	14	14A	14A	14	14	14
U. S. S. R.	3	3	3	3	3	3B	7A	14	7A	7B	3B	3
WEST COAST	14	7	7	3	7	7	3	7	14	14A	14A	14A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	7A	14	14
ARGENTINA	14	7B	7	7	7	7	7B	14	14	14	14	14A
AUSTRALIA	14	14	7B	7B	7	7	3B	7	14	14B	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	14	14A	14A	14A
ENGLAND	7	3	3	3	3	3	3B	7A	14	14	7B	7
HAWAII	14	7B	7	3	3	3	3	3	7	14	14A	21
INDIA	3	7	3B	3B	3B	3B	3B	7	7A	7	7B	7
JAPAN	14	7B	7	3	3	3	3	3	3	3B	7	14
MEXICO	7A	7	3	3	3	3	3	7	14	14	14	14
PHILIPPINES	14	7B	3B	3B	3B	3	3	3	7	7	3B	7
PUERTO RICO	14	7	7	7	7	3	7	14	14	14A	14A	14
SOUTH AFRICA	7A	7	3A	3A	3A	3B	7B	14	14A	14	14	14
U. S. S. R.	3	3	3	3	3	3B	3B	7A	7A	7B	3B	3B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	7	14	14
ARGENTINA	14	7B	7	7	7	7	7B	7B	14	14	14	14A
AUSTRALIA	14A	14A	14	7B	7	7	7	3B	7	7A	14	14
CANAL ZONE	14	7	7	7	7	7	3	7A	14	14A	14A	14A
ENGLAND	7	3	3	3	3	3	3B	7	14	14	7B	7B
HAWAII	14	14	14	7	7	7	7	3	7	14	21	21
INDIA	3	14	3B	3B	3B	3B	3	3	7	7	7	7B
JAPAN	14	14	7B	3	3	3	3	3	3A	3A	7	14
MEXICO	14	7	3	3	3	3	3	7	14	14	14A	14
PHILIPPINES	14	14	7B	3B	3B	3	3	3	7	7	7B	14
PUERTO RICO	14	7	7	3	7	3	3	7A	14	21	21	14
SOUTH AFRICA	14	7	3A	3	3A	3A	3B	7B	14	14	14	14
U. S. S. R.	3	3	3	3	3	3B	3B	3	7	7	3B	3B
EAST COAST	14	7	7	3	7	7	3	7	14	14A	14A	14A

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

AMATEUR RADIO

73

W8KEY Works 100 Countries on SSTV (p. 120)

one inflated dollar
FEBRUARY 1975

DOCKET 20282 COMPLETE !

SUPER–KEY (p. 31) . . .

Your Own Repeater (p. 76) . . .

OSCAR 7 (p. 46, 54, 62) . . .

SSTV –
Fast Scan Monitor
Grey Scale Generator

73 amateur radio

#173 FEBRUARY 1975

COVER: Gene Kundert W8YEK (page 120).

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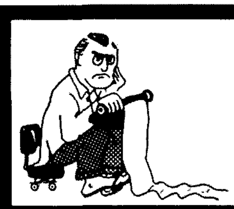


NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

RESTRUCTURING HAS ARRIVED!

The FCC docket proposing sweeping changes in our rules is reprinted in full in this issue. Instead of telling you what it says, it will be better if you take the time to read the whole docket through carefully – making notes as you go – and consider it as a whole.

Many amateurs will find one or more parts of the proposals which will be objectionable. Though this may be like trying to hold back the incoming tide, it is suggested that you make every attempt to view the proposed rules in the context of an overall pattern and try, as best you can, to overlook any ways that you, with your present grade of license, will be affected. Keep in mind, as much as you can, that the FCC has written these proposals with the view of having a set of rules which will achieve certain ends:

More amateurs instead of fewer.
True incentive to upgrade tickets.
Minimum impact on present licenses.

In evaluating the docket, it is suggested that references to CB operation only be used if you have been an active CBer and really know what you are talking about. Draw upon your personal knowledge, not what you've read or been told. The fact is that there has yet to appear any honest evaluation of CB operation in the amateur press. The same reservation holds with respect to popular biases for and against Novices, Techs, Conditionals, and such. In your comments draw upon *personal experience,* and try to keep perspective.

It will take a lot of discussion over the air, at radio clubs, and with friends to develop a rounded and clear understanding of the docket and its ramifications such that you will be able to comment and make suggestions intelligently.

It looks as if we will get a good shake on this one – unlike the "incentive licensing" disaster which was turned over to someone with no understanding of amateur radio to be developed – and which failed utterly – making this docket necessary. We have five months leeway to work out our responses to 20282, so let's get working on it.

QRP LICENSE PETITIONED

RM2463, filed with the FCC, requests that a new class of license be set up which would avoid all math calculations. It would have a 5 word per minute code exam and a simple test for rules, CW operating procedures and basic CW theory. Privileges would include 5 or 10 watts power in a small segment of a seldom used part of a band . . . perhaps the lower part of 10m.

Having recently made a set of cassette tapes of the Novice theory as well as the five words per minute code tapes, I think I can say that the present Novice exam is pretty damned simple. I note that kids of 9 and 10 years are able to pass it and I really wonder how many people are really unable to cope with this simple exam. W9EHR/7, who submitted the petition, says that this class of license was inspired by his work with older people and that many of them are unable to make the arithmetic calculations called for on the Novice exam. He feels that many older people don't even try for the Novice license because they don't have a high school education . . . and he feels that amateur radio would be a great blessing for these lonely people.

Undoubtedly amateur radio has a lot to offer lonely people, if only we could get the word to them and get them interested enough to try it. But do we need to simplify the Novice test for this?

WHAT CAN I DO . . . ?

A great many amateurs are concerned over the steady drop in the number of radio amateurs and feel that something should be done about it – but they are frustrated – for after all, what can one individual do? The fact is that just a handfull of seriously interested amateurs could do a lot and could easily turn the whole situation around.

The circumstances that have gone

into making the situation we have today are mostly the result of neglect — of apathy. "Incentive licensing" may have hurt us a lot more than many amateurs realize and the results are still with us.

Now, to get down to brass tacks, here are some ways of helping that can be undertaken by individuals:

1. Help your local ham club. What clubs can do to help will be covered later.

2. Help high school ham clubs. This means helping them to form, offering advice to youngsters, helping them set up license study classes, helping them get a club station going, etc.

3. Give talks. Civic groups are always looking for speakers — so talk to the Rotary, Lions, etc., about the benefits of amateur radio to the community and to the country. Talk to Boy Scout groups — invite them over to see your station — help them start a ham club. Talk to CB groups.

4. Sport a bumper sticker which says, "Ask Me about Ham Radio." You'll get action from CBers and others.

5. You can spark interest on the air on the low bands or via repeaters if you organize a code practice broadcast — a theory broadcast, perhaps with Q&A afterwards. Perhaps you can set up a beacon to help VHFers know when the band is open. Or perhaps you can broadcast news bulletins of interest to amateurs such as are published in the Hotline and other ham newsletters.

HOW CAN CLUBS HELP?

1. Demonstrations set up in shopping plazas to interest people. This can be followed up with a pamphlet explaining the benefits of amateur radio as far as a career is concerned — as an antidote to loneliness — and for fun. Club bulletins giving info on club meetings and study classes can also be used to follow up leads.

2. Demonstrations at high schools. Half of the Novices last year were 14 and 15 years old. This is where the career pitch can be particularly valuable in attracting new blood.

3. Get license study classes set up with code practice, theory talks, Q&A sessions.

4. Get prospective amateurs to come to club meetings and study courses by means of those demonstrations — ads in the local papers — posters in the radio stores — posters in high schools — publicity on the radio

Continued on page 135

HOTLINE HEADLINES

. . . late breaking news for the active radio amateur . . . in summary.

OSCAR 7. The launch was successful and much DX is being worked via O7.

Couple Murdered? Amateur radio reports responsible for helping catch a woman involved with possible murder of boating couple at Palmyra Island.

CARF Opposes GRS Skip Proposal. The Canadian Federation filed in opposition to the proposed plan to permit Canadian CBers (GRS) work skip and hobby on 11m.

Aviation Week Oscar Article. October 28th issue has a great article on Oscar 7.

KC4NI Makes It. Navassa Island active again as W2 group fired up.

FK0 DXpedition. California group active from New Caledonia. Previous stop was Wallis as FW0.

Most Wanted DX List. Top DXers need Clipperton, Bouvet, So. Sandwich, etc.

Restructuring News. Communicator Class license certain now — Conditional to be non-renewable — new calls.

Truck CB Prohibition. The ICC proposes to prohibit CB in trucks! May be able to get away with this.

Police CB Licenses Issued! State police heading for massive installation of CB units — 2000 in Illinois alone — Smoky may soon talk back — and bite.

WR Calls Mandatory Soon. FCC will soon require all repeaters to have WR call if they are to continue to operate.

Sun Spot Madness. 73's expert Nelson predicts incredible events for the next cycle.

New ID Plan Proposed. Standardized tone for ID of 102 Hz so it can be filtered out by receivers when not needed.

CB Dealers Fight 20118. Dealers and manufacturers furious over CB linear outlaw rule.

Oregon CB Couple Caught. CB was used in the bomb threat and direction finding units located them.

License Fees. New wrinkle — FCC license fees may be dual taxation and thus illegal.

FCC Sideband Policy. Standards for unwanted sidebands which seriously effect 3999ers and other band edge ops released.

Clegg Synthesizer. Details released on the new Clegg rig — looks fantastic.

Clegg Contacts Coordinators. Clegg is working with frequency coordinators before shipping repeaters to make sure channels have been cleared.

ARRL Elections. All incumbents elected again. Ho hum.

Jordan Off VE Banned List. The recent visit of JY1 to Canada helped to clear the red tape and make it possible for Canadian amateurs to contact JY stations.

Direct Mail Sales Gaining. Genave switch to mail order was successful — many other firms considering the switch.

QST Printing Costs Up. The ARRL reported that costs have risen about 33% in 1974 over the same period in 1973. Loss in third quarter was a reported S45K!

Amsat Oscar 7 Covers. First day stamped covers available for collectors.

Electronic Design Apologizes. Their boo-boo labeling CBers as hams brought an apology.

Dallas War Chest. The DARC is getting ready for a fight against a local tower ordinance — asking for contributions.

W8YEK Makes 100C on SSTV! The first 100 country slow scanner.

FCC. Caught in sneaky "editorial revision."

Law of the Sea Conference Fails. Oceanus prospects better.

DX Advisory Committee Changes. ARRL committee gets four newcomers.

New Country Soon? Hutt River Province Principality applies for ITU sanction.

New IRC Coupons Issued. Old ones will be good for two years.

New FCC Prefix Issued. Look for WD6's — honest.

IFRB Study of HF in Progress. Report due ITU later this year, key to possible new bands.

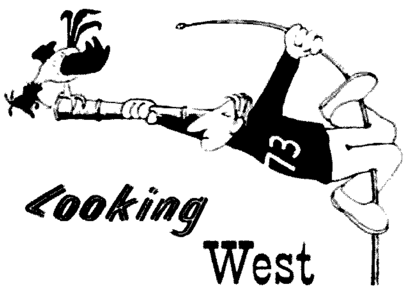
Alien Licensing. Senate bill 2457 has passed Congress and awaits Presidential signature.

Flying Magazine Ham Article. Stresses autopatch 2m repeater operation. Many alarmed.

A5 Magazine in Trouble? Another specialized ham magazine folding?

ATV Repeater DX. WA3BIB works into Washington from 70 miles out.

VE3AHU Awarded Trophy for work in building CARF.



Bill Pasternak WA2HVK/6
14725 Titus St. #4
Panorama City CA 91402

It's hard to be objective when I write about the Palisades Amateur Radio Club and the many things that we accomplish. In the past I tended to avoid writing about P.A.R.C. inasmuch as I am very involved in the club and my remarks would tend to be anything but impartial. However, any radio club that brings along it's own repeater, complete with voice ID and special call sign, more than deserves a mention here. When we realized how many P.A.R.C. people were planning to attend the San Diego Convention, the idea of a portable repeater on the .01 – .61 WR6ABB channel was born in the mind of Fred Deeg K6AEH now P.A.R.C.'s Vice President. Fred applied for and was granted the Special Events Call sign WR6FM for use at the convention. Neil McKie WA6KLA, who might know more about Motorola two way FM equipment than the people that designed it, put a Motrac, a Mocom, my Norelco Carry-Corder and a few other pieces of peripheral equipment together and made an instant repeater with better coverage than the .34 – .94 official convention talk-in machine. (I personally tried both and .01 – .61 was usable for a greater distance than .34 – .94.) Did WR6FM get use? When a radio club full of .01 – .61 users invades an Amateur Radio Convention what would you think? Next stop is S.A.R.O.C. and hopefully WR7FM.

There is a growing trend on Southern California repeaters, ones of the non club sponsored variety, toward formation of user representation groups. These are amateurs who have organized to provide financial support to their favorite repeater while leaving matters of technical performance and operating practices to the discretion of the licensee. Organizations such as the Mt. Wilson Repeater Association and Mt. Lee Repeater Association coordinate monetary donations, user technical assistance to the licensee and social functions amongst themselves. One of the matters discussed at length at the Southern California Repeater Association meeting held at the San Diego Convention was the official recognition of these groups by S.C.R.A. and granting them voting privilege. Though a number of different plans were offered in this direction, it was decided that giving user vote in an organization designed to coordinate repeaters and the needs of their owner/licensees/trustees might tend to undermine the organization in the future. At the moment it is the repeater owner who is responsible in the eyes of the FCC for his system (though 20112 will substantially change this) and it is felt among the majority of repeater owners attending this meeting that any decisions that affect their respective systems are theirs alone to make. Therefore, such user groups can only remain as non-voting associate members. While this gives them and any other interested associate member a voice in any debate on any question, it will remain to the voting members, the repeater owners and licensees to make any final decisions.

About a year ago, the hottest controversy in the Los Angeles FM world was if a .34 – .94 repeater could survive in an atmosphere divided heavily pro and con. Those opposing it went as far as starting a group then called "Save our Simplex" to oppose it. It seems that all the controversy was for naught since, after a few tests, WR6ABO never went into full time operation. After waiting about nine months, six months more than necessary under the S.C.R.A. rules, the sanction of WR6ABO was cancelled by the S.C.R.A. Technical Committee due to total inactivity. Whether anyone else will apply for it in the future is in doubt. It's one of those hot-potatoes, as is .16 – .76. However, the latter has been sanctioned to the San Diego area and it will be interesting to see the reaction when that system gets into operation. In the L.A. area, and here in the San Fernando Valley especially, 146.76 is a heavily used simplex channel 24 hours a day. If care is taken to keep its signal out of L.A. proper it may well survive with little opposition.

When the S.C.R.A. was formed two years ago, there were so many pressing problems locally that our neighbors "South of the Border" were all but forgotten. At that time there was little FM activity and no repeater operation in that area. But times change and so do the needs of amateurs everywhere. Mexico is a very dramatic example of this. Our XE brothers have discovered the advantages of FM Repeater operation and are busily at work setting up a band-plan along with a number of wide coverage machines to provide coverage from the border on South. One of the most important needs of the Mexican amateurs to implement this communication system was a couple pairs of standard 30 kHz channel allocations; ones that would not interfere with or be interfered with by existing Southern California repeaters. By reshuffling a couple of existing smaller repeaters to either shared or split channels, our XE neighbors now have at least one of the two allocations they requested and the second will be following in short order. Looking West would like to hear from the amateurs in Mexico to know how their work is progressing.

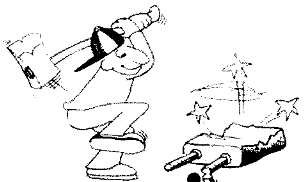
Finally, as of this writing, December 1, 1974, none of the split-split allocations for Southern California have been officially designated, so it will be a little time yet till we can let you know how well things are working. As soon as we know, you will know.

Not long ago I was forced to report the demise of the open autopatch function on the WR6ACK repeater in West L.A. While ACK was the first attempt at such a service, another such system has come into existence and from all reports is having far less trouble than did ACK. Operating on 147.72 – 147.12 is WR6ADH in its home in the Montery Park area of Los Angeles. ADH offers better coverage, both radio and telephone dialing area than did ACK and has been quite lucky in that the phone-freaks have left it alone to grow. On the ADH system, you can call from Malibu on the west to Fontana on the east; Newport Beach on the south to Palmdale on the north. In fact, there are few areas that you cannot call, and over a hundred dialing prefixes are toll free. Anyone desiring more information on the WR6ADH autopatch system should send a SASE to WR6ADH, P.O. Box B, San Gabrial, California 91778. They will supply you with an informative letter that goes into far more detail than I have room for here.

As you read this in February, another meeting of the Southern California Repeater Association will be taking place. If you read this before February 2, and want to see how a well organized repeater coordinating organization is run, the time

is about 10 AM at the Belvedere Park Gym in East Los Angeles. The mid-February issue of HOTLINE will carry the highlights and a complete update will appear in April Looking West. Oh yes, the Mt. Wilson Repeater Association will be host for this S.C.R.A. meeting.

. . .de WA2HVK/6



novice

Schley Cox WB9LHO
1613 Culbertson Avenue
New Albany IN 47150

LESS IS BETTER

Some Novices can't wait to put away their key when they get their General ticket. For them CW operation has become a horror to be endured at the insistence of the FCC.

Other Novices learn to appreciate CW for what it can do and find themselves at home with either a key or a mike when they upgrade their ticket. One group probably learned the proper use of abbreviations and Q-signals; the other one didn't.

Consider the two following statements. (A) THANK YOU FOR THE CALL OM // YOUR SIGNAL RST IS 569 569 AND MY QTH QTH IS NEW ALBANY, INDIANA NEW ALBANY, INDIANA // NOW BACK TO YOU . . .; and then; (B) TU RST 569 QTH NEW ALBANY, IN // HW? . . .

The statement (A) may sound a little friendlier at first than (B) but it contains 77 more characters. It takes three times as long to send. If a CW operator carries on a conversation spelling out every word, repeating almost every other word and being redundant with the Q-signals, it won't take long for him or her to decide that a microphone is the only way to go in amateur radio.

There's no need to send "MY QTH IS . . ." because sending "QTH" means "My location is . . ." Sending it the first way actually means "MY MY LOCATION IS IS . . ." That sounds silly when you read it that way but many amateurs (not just Novices) send four extra characters every time they tell someone where they are.

How about "YOUR SIGNAL RST IS 579"? "RST 579" means the same thing and is a lot shorter to send: A little savings here and there begins to add up.

"WHAT KIND OF ANTENNA DO YOU HAVE?" could be sent "WHATS UR ANT?". "WELL I GUESS I HAVE RUN OUT OF THINGS TO SAY HERE" could be sent "QRU".

An efficient CW operator, whether sending at 5 or 25 wpm, avoids sending what is already obvious. What do the numbers 40475 or 80816 mean to you? Of course they are ZIP codes. There is no need to send "ZIP HR IS 40475." Just send the numbers after the address. The operator on the other end will understand.

Once you get the preliminaries out of the way, rag chewing can go a lot faster and be a lot more enjoyable if both operators use some common abbreviations and techniques.

Keep a list of CW abbreviations and Q-signals at your operating table. Try to use them as much as possible while keeping your meaning clear.

A little on-the-air experience will tell you if you need to repeat your location or name in order for the operator on the other end to copy you most of the time. If you live in Chicago, there's no need to send "QTH CHICAGO, IL CHICAGO, IL". Most operators will know where you are the first time around. If they don't they can send "QTH?".

If you live in Paoli, IN or Florissant, CO or someplace with a less than common name, some on-the-air experience may tell you that you should repeat the name so that the operator on the other end won't have to wonder if he copied correctly.

Despite urges to adopt some nickname like "Rocky" or "Bob" I stick with my given name on the air. I send "NAME SCHLEY SCHLEY OM". The operator on the other end can check his copy with the repeat and not have to worry about my gender.

If you can think of a way to shorten how you say what you have to say on CW you may find that your key, keyer or bug gets to stay on your desk next to your mike when you drop the N.

If you have a particularly good (or bad) experience getting your Novice ticket, waiting for it to arrive, learning the code, studying for the written test, or setting up a station, let me know. I would like to get some information together for a column or two on preparing for the test and setting up that first station.

If you have an idea for a topic you would like to see discussed here drop me a line (or better yet, send an amateur radiogram). GL ES HPE CU SOON.

TRAVELING Ham

Joe Kasser G3ZCZ
1701 East West Highway, Apt. 205
Silver Spring MD 20910

The Traveling Ham

This month I'd like to continue with the listing of European repeaters.

Austria	
Gmundnerberg	R2
Klagenfurt	R4
Linz	R6
Patscherkofel	R2
Kufstein	R5
Kaiserkogel	R4
Krippenstein	R5

All these repeaters have call signs in which the first letter of the suffix begins with an X, (eg. OE5XGL).

The *French* licensing authorities have a new address: Direction Telecommunication Du Reseau International Service Radio Amateur, Immeuble PTT Bercy, F.75584, Paris, Cedex 12. This address is to be used when making enquiries about reciprocal operating.

This month's column is based on material published in the August 1974 issue of The International Amateur Radio Union, Region 1 News.

Two meter activity in Cyprus is on the increase, and last summer produced some good openings into Israel. Contacts were made almost every day and strong signals were heard both in Cyprus and in Israel, even from stations using hand held 1 W rigs. The calling frequency in Cyprus is 144.6 MHz. The propagation seems to be mainly due to tropospheric ducting. I can remember viewing TV programs from all over Israel and the Middle East when I was out in that part of the world, so two meters should be excellent.

Two meter activity is catching on strongly in Israel, up till quite recently there was very little interest in VHF in two meters because for political reasons there was very little DX activity on the band, but now with AMSAT-OSCAR spacecraft in orbit the DX aspects of two meters have suddenly increased enormously.

If you are going to *Denmark*, you can get a reciprocal operating permit by filing an application at least one

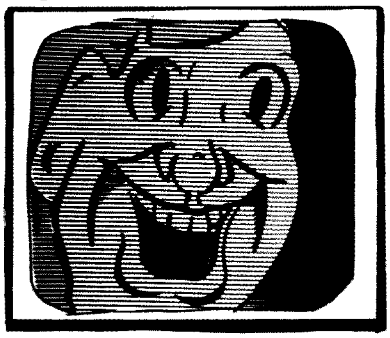
month before you need it. The application form may be obtained from: The General Directorate of Posts and Telegraphs, 1st Technical Office, 17, Farvergade, 1st Floor, DK-1007 KØBENHAVEN K. The fee to be paid for the license is D.kr.50.0 and it is to be paid by means of a special inpayment form, which is sent to the applicant together with the license. The fee shall not be paid until after the arrival of the applicant in Denmark. If the stay in Denmark is greater than a period of more than three months the usual application for a Danish amateur radio license should be sent in. The Danish repeaters were listed in the last traveling ham column.

The two meter scene in *Italy* is also humming. There are nearly one thousand amateurs on two meter FM and they are planning a repeater chain to cover the whole country. Italy does have a reciprocal agreement with the other common market countries and last summer over 60 Europeans took advantage of that agreement to obtain permits to operate in Italy. Most of those were from West Germany. For prefix hunters the IW prefix identifies stations having a "Technician Class" license who are permitted to operate on frequencies above 144 MHz with a maximum input power of 10 W.

To those of you who sent in encouraging notes and QSLs, here are my thanks. It is nice to know that the long hours spent pecking away at the keyboard are appreciated.

. . .G3ZCZ

SSTV SCENE



Dave Ingram K4TWJ
Rte 11, Box 499 Eastwood Vil. 604 N.
Birmingham AL 35210

The WØLMD Digital Slow to Fast Scan converter is off and flying in fine shape. W8URX is producing printed circuit boards of the unit and sending them to Phil WA9UHV. Phil adds the printed information, sketches, layouts and distributes them to the interested parties that contact him. This Scan converter package consists of nine double sided printed circuit boards. Eight of these boards are the scan converter, and the ninth board is a test jig for checking surplus 1024 bit shift register ICs used in the unit's memory. The main expense in this scan converter is the 1024 bit memory ICs. Unless one owns a gold mine, these #2525 or #2504 MOS shift registers must be purchased surplus. The good/bad ratio of these chips average 75/25, thus the test jig is very convenient for locating the good memory chips. Surplus 2525 MOS memories may be difficult to locate, so I suggest you secure these while planning a Slow to Fast Scan converter.

Possibly this scan converter business is confusing. Since these converter units are beginning to play a large role in the SSTV field, let's try to clear the air on them. There are two types of Digital Scan Converters: The Fast to Slow Converter and the (new) Slow to Fast Converter.

The Fast to Slow converter connects to any conventional (Fast Scan) camera and outputs directly with Slow Scan TV. No modifications to the camera are required. Two variations of this unit are presently available. The WØLMD unit appeared in August 1974 73 Magazine. Printed circuit boards of this unit are available for a nominal sum from K7OLO or W8OZA. W8OZA also handles the SSTV Keyboard information and PC boards. This unit appeared in October 1974 CQ Magazine. The other Fast to Slow Scan Converter is available directly from its designer, W6MXV. This unit may be purchased in either PC boards only (2), PC boards plus parts, or wired and tested PC boards. Prices range from approximately 30 dollars to 200 dollars. Both previously mentioned scan converters produce extremely good results.

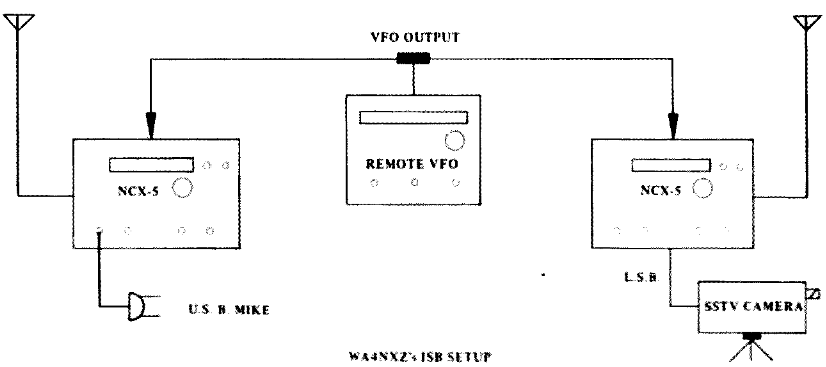
The Slow to Fast Scan converter is new. Details on this converter have yet to appear in any magazine. This converter replaces an ordinary P-7 monitor. The unit connects between your HF receiver and a conventional (fast scan) television. No modifications to the television are required. The incoming SSTV is then displayed as large, bright pictures. Memory circuits allow the last frame received to be indefinitely displayed on the TV screen. Although this unit is perfected, and works beautifully, it is still undergoing refinements by its SSTV designers. Meanwhile, as previously

Bob W9LUO of SSTV fame. I'm sure many of you know of his "W9LUO Monitor."

mentioned, information and PC boards are available from Phil WA9UHV.

Volunteers Needed

As you may have noticed, weekends of major contest activity play havoc with Slow Scan TV communications. Many contest operators are congenial, understanding people who simply are not informed of SSTV work. A volunteer is needed to contact the major contest committees and relate the role SSTV plays in pioneering communication technology, plus relate the popular SSTV frequencies. We also need someone with time to write guest editorials of Slow Scan operations and to request special frequencies (like 14.190 MHz) for SSTV use. The end results should yield more respect for on-the-air SSTV operation. If you would like to handle the task



WA4NXZ's ISB SETUP

and need assistance, drop me a cassette tape or meet me on 14.230 kHz Saturdays around net time.

Newsy Happenings

Henry WA4NXZ is operating Independent Sideband using a pair of NCX-5's slaved to one remote vfo. He pulled the oscillator transistors from each rig and fed the remote vfo signal to both transceivers. One NCX-5 was switched to upper sideband and the other NCX-5 was switched to Lower Sideband. Henry is building a four-811 linear which will have the capability of operating all four tubes on audio or video — or switched to operate two 811's on voice and two 811's on video. The linear's output will feed one antenna.

Although WB5IXK didn't submit a log last year, he placed second in the world-wide Slow Scan TV contest. He used a felt pen and fast hand to rack up a high score. I understand that he will be operating a SSTV Keyboard this year. Hmmm quite a few fellows are beginning to build PC board circuits. BRAVO!

KH6HJF has been transmitting SSTV to several JA's via Oscar, but still awaits a two way Slow Scan QSO via the satellite.

W2DD, an old time SSTVer, is now writing the SSTV column in World Radio News.

W6EYY reports that Slow Scan activity in Japan is steadily increasing. JA activity is heard between 0530 and 0700 GMT around 14.230 MHz, and on 21.340 MHz between 2200 and 0100 GMT. His list (in this month's column) of JA's worked on SSTV is a nice guideline of Japanese stations presently operating SSTV. Now you know who you should hunt.

JA0BZC	JA7FS
JA0CVF	JA0AXV
JA6DG	JA8ARA
JA1EOD	JA4ONU
KA2EI	JA7EYL
JA7GY	JH1HFE
JA8ACP	JA1VUI
JH1PZN	JA6ARW
KA2DF	JA2LVK
KA2MW	JA0OE
	JA2KB

List of Japan SSTV Stations worked by W6EYY.

SSTV ADDRESSES

WA9UHV — Phil, 4012 Carmelita Blvd., Kokomo, Indiana 46901. Slow to Fast Scan Converter boards and info.

W6MXV — Mike, 6941 Lenwood Way, San Jose, California 95120. Fast to Slow Scan Converter Boards and kits.

W8OZA — Russ, 1411 Lonsdale Rd., Columbus, Ohio 43227. Fast to Slow Scan Converter and SSTV keyboard, boards.

K7OLO — Jim, 2930 Sorrel Way, Eugene, Oregon 97401. SSTV Keyboard info and boards and Fast to Slow Scan Converter boards.

SLOW SCAN CONTEST ANNOUNCEMENT

The yearly worldwide Slow Scan TV contest is happening again during the eighth and ninth of this month, and a large amount of activity is expected. This will be a joint contest with 73 awarding a year's subscription to the world winner. U.S. stations should send me, K4TWJ, a duplicate of their logs and scores to be eligible for the 73 award. Don't forget to include a photo with your results. We will run the photo (and contest results) in this column, then return it to you. Notice in the accompanying rules that past winners face a six per cent deduction handicap, and each U.S. call area is considered as a separate country. As usual, the information exchange (call sign, report and QSO number) must be via Slow Scan TV but audio IDs are permitted for FCC legality. Good luck, and we hope to "see" you in the pileups!. . .K4TWJ

World Wide SSTV Contest Rules

Sponsored by the cq elettronica and 73 Magazine.

The Italian Magazine cq elettronica and the American 73 Magazine have pleasure in announcing the 5th Worldwide Slow Scan Television Contest.

The purpose of this Contest is to promote increased interest in the SSTV mode of operation as used by Radio Amateurs.

RULES

1) PERIOD OF CONTEST

Part 1 15.00-22.00 GMT on February 8th 1975

Part 2 07.00-14.00 GMT on February 9th 1975

2) BANDS

All authorized frequencies within the 3.5-7.0 – 14.0-21.0 & 28.0 MHz bands.

3) MESSAGES

Messages will consist of: Exchange of pictures and also included are a) the call sign; b) report (RST); c) serial number.

The serial number must start at 001 and is increased by one for each successive contact during the period of the Contest and the serial number is irrespective of the Band(s) used.

Exchange must be made exclusively with the SSTV mode. For the "W" are accepted the FCC rules.

4) EXCHANGE POINTS AND MULTIPLIER

a) Contact score 1 point per contact on the 3.5, 7.0, 14.0, 21.0 MHz Bands. 2 points per contact on the 28.0 MHz Band.

b) A multiplier of 5 points for each Continent (Max 30 points) and 2 points for each Country (ARRL List) worked can be utilised on each band. In addition to the ARRL List will be considered as separate Countries the W call areas W0 to W9 and VE Call areas from V0 to VE7.

The same Continents and Country is only valid once on each Band. The same station can only be worked once on each Band (Max 5 contacts) during Contest period.

5) SCORING

Total exchange points multiplied by the multiplier total.

6) HANDICAP

Winners of precedent Contest: less 6% of the total final score.

7) SECTIONS

a) Entrants transmitting and receiving video.

b) Entrants receiving video only. For this purpose the same general rules apply and the same station heard is valid once only on each Band.

A separate results table will be made for each of these two classes of entry.

8) LOGS

Logs should contain: Date, Time of contact (GMT), Band in use, Call sign, Report (RST) sent and received. Serial numbers sent and received, points, multipliers and final score.

Although not essential, it would be appreciated if entrants could enclose a cover sheet with a short description of the Station (With photo if possible) together with any comments on the Contest.

All entrants are kindly requested to report on any serious Contest irregularities e.g Exchanges in other modes.

For entrants in the b. Classification it is only necessary to record the message of the station heard.

All Logs must be received by not later than March 25th 1975 in order to qualify.

Send them to:

Prof. Franco Fanti
Via A. Dallolio n. 19
40139 Bologna ITALY

9) PRIZES

1° A free 12 month's subscription to cq elettronica Magazine

2° A free 6 month's subscription to cq elettronica Magazine

3° A free 6 month's subscription to cq elettronica Magazine

10) RULES OF BEHAVIOUR AND PENALIZATION.

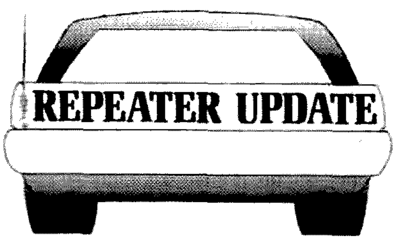
The Logs must be compiled in accordance with the Rules listed in (7). The contacts must be made by means of the SSTV mode and it is not permitted to use other mode of transmission either before, during or after the exchange of message by Slow Scan TeleVision.

During the Contest it is expected that Amateurs will observe the fundamental rules of courtesy and good operating during contacts.

Failure to observe any of the above Rules will result in the exclusion of the entry from the final results and any such Logs received will be considered as check Logs.

All Logs received become the property of the Edition CD and will not be returned.

The decision of the organising Committee in any dispute will be final and any subsequent controversy cannot be referred to the Civil Court.



* – *New*
† – *Change*
D – Delete

ALABAMA

*WR4AJN	Demopolis	146.04	146.64
*WR4AJF	Dothan	146.25	146.85
*WR4	Eufala	146.19	146.79
*WR4	Evergreen	146.16	146.76
†WR4AEZ	Gadsden	146.22	146.82
†WR4AGI	Gadsden	146.37	146.97
*WR4ADX	Headland	146.16	146.76
†WA4UAG	Huntsville	CLOSED	
*WR4AGB	Mobile	146.10	146.70
*WR4AHQ	Mobile	146.22	146.82
†WR4AJH	Montgomery	146.34	146.94
*WR4AKM	Opp	146.04	146.64
†WR4AIC	Phenix City	146.28	146.88
*WR4AHH	Troy	146.22	146.82

ARIZONA

*WR7AEK	Casa Grande	146.37	146.97

ARKANSAS

*WR5AGS	Mountain Home	146.28	146.88

CALIFORNIA

†WR6AHK	Alamo	147.66	147.06
*WR6ADI	Auburn	222.26	223.86
*WR6ABX	Berryessa Pk	223.22	224.82
*WR6AEN	Folsom	222.50	224.10
*K6IS	Folsom	222.98	224.58
*WR6AFN	Kensington	223.26	224.86
*WR6ADC	Marin	222.10	223.70
*WR6AEE	Montebello Ridge	223.34	224.94
*WA6ZUB	Mt San Bruno	223.06	224.66
*WR6AFU	Mt St Helena	222.42	223.02
†WR6AHB	Mt Umunhum	147.795	147.195
†WR6ABH	Mt Umunhum	147.75	147.15
*WR6ABH	Mt Umunhum	222.02	223.62
†WR6AEI	Mt Vaca	147.87	147.27
*WR6AGO	Mt Vaca	222.34	223.94
*WR6AGJ	Mt Vaca	CLOSED	
†WR6ADW	Otay Mtn P	147.99	147.39
*WR6AFL	Point Loma P	147.99	147.39
*WB6ZGT	Shingle Springs	CLOSED	

COLORADO

*WR0AGN	Black Forest	146.19	146.79

CONNECTICUT

*WR1ADT	Farmington	146.37	146.97
†WR1ABD	Groton	146.07	146.67
†WR1ABR	Stamford	146.055	146.655

FLORIDA

D–WR4ACV	Boca Raton	146.34	146.94
*WR4ACV	Boca Raton	146.34	146.82
*WR4	Fernandina Beach	146.01	146.61
†WB4ZAY	Ft Myers	146.28	146.88
*WR4	Ft Pierce	444.0	449.0
*WR4	Jacksonville	146.07	146.67
*W4FWV	Miami	146.40	147.00
*WR4AHN	North Dade	CLOSED	
*WR4AGW	Orlando	146.04	146.64
*WR4AJM	Orlando	146.19	146.79
†WR4AEO	Orlando	146.58	147.18
†WR4AER	Orlando	147.72	147.12
*WB4SKI	Pensacola	444.5	449.5
†WR4AGO	St Petersburg	CLOSED	
*WR4AGP	St Petersburg	CLOSED	
*WB4HAE	Tampa	146.25	146.76
*WR4	Tampa	146.28	146.88
*WR4	Tampa	147.03	147.63
*WB4QEN	Tampa	449.1	448.1
*WR4AKX	West Palm Beach	146.34	146.94
*WR4	West Palm Beach	146.37	146.97
*WR4	Winter Garden	146.34	146.94

ILLINOIS

*WR9	Chicago	223.26	224.86
*WR9ADO	Chicago	147.78	147.18
*WR9AER	Sterling	146.25	146.85

INDIANA

†WR9ABD	Evansville	52.92	52.575
*WR9ABN	Fort Wayne	147.60	147.00
†WR9ABA	Indianapolis	146.10	146.70
*WR9AEP	Indianapolis	147.66	147.06
†WR9AEK	South Bend	146.34	146.94
*W9EZS	South Bend	146.70	146.10
†WR9AEL	South Bend	147.93	147.33
†WR9AEF	Wabash	147.63	147.03

IOWA

†WR0ACO	Ames	146.16	146.76
†WR0ACF	Ayrshire	146.22	146.82
*WR0AGJ	Cedar Rapids	CLOSED	
†WR0AGM	Cedar Rapids P	147.69	147.09
†WR0ABY	Clarinda	146.37	146.97
†WA0HLM	Clinton	146.07	146.67
†WR0AGK	Creston	146.19	146.79
*WR0AEB	Davenport	146.04	146.64
*WR0	Davenport	146.28	146.88
†WR0AEZ	Des Moines W	146.34	146.94
†WR0AFN	Des Moines	146.22	146.82
*WA0ITC	Des Moines	449.50	444.50
*WR0	Knoxville	146.13	146.73
*WR0AEY	Sioux City	146.37	146.97

KANSAS

*WR0AGO	La Crosse	146.16	146.76

KENTUCKY

*WR4AJW	Louisville	146.07	146.67
*WR4AKI	Somerset	146.28	146.88

LOUISIANA

†WR5AEN	New Orleans	CLOSED	
*WR5	New Orleans	146.04	146.64
*WR5	New Orleans	CLOSED	
*WR5	New Orleans	CLOSED	

MARYLAND

*WR3AEK	Suitland	444.40	449.40

MASSACHUSETTS

*WR1AEB	Barnstable	146.13	146.73
†WR1AEO	Brookline	CLOSED	
†WR1ADA	Charlton	146.28	146.88
†WR1AEK	Fitchburg	146.46	147.46
†WR1ABK	Foxboro	146.355	146.955
*WR1ABZ	Holliston	147.855	147.27
*WR1ADG	Lexington	147.795	147.67
†WR1AFI	Mt. Greylock	146.31	146.91
†WR1AEH	North Adams	146.43	147.03
†WR1AAI	Quincy	146.07	146.67
†WR1ACR	Somerville	146.145	146.745
†WR1ACM	Stoughton	146.175	146.775
†WR1AEF	Westfield	146.10	146.70

MICHIGAN

†WR8AEC	Detroit	147.98	147.36
†WR8AEZ	Detroit	147.96	147.36
†WR8ABN	Detroit	CLOSED	
*WR8ADK	East Tawas	146.34	146.94
†WR8AEE	Grand Blanc	449.2	444.2
†WR8AFR	Howell	222.50	224.10
*WR8	Mount Clemens	147.75	147.15
†WR8AEK	Trenery	146.16	146.76
†WR8ACY	Whitmore Lake	147.81	147.21
*WR8	Wyandotte	147.84	147.24
D–WR8	Wyandotte	147.75	147.15

MISSISSIPPI

†WR5AGG	Hattiesburg	146.22	146.82
†WR5AFN	Vicksburg	146.19	146.79

NEVADA

†WR7ABN	Virginia City/Reno	146.16	146.76

NEW HAMPSHIRE

†WR1ADY	Francistown	146.19	146.79

NEW JERSEY

*WR2AEA	Blackwood PL W1.8	146.22	146.82
D–W2FLY	Camden	146.22	146.82
†WR2ADB	Denville	CLOSED	
†WR2ADT	Greenbrook	146.34	146.94
†WR2ACS	Martinsville	CLOSED	
†WR2ADV	Paramus	CLOSED	
D–WB2ZWG	South Jersey	146.22	146.82

NEW MEXICO

*WR5ADX	Alamogordo	146.22	146.82

NEW YORK

†WR2ACW	Bethpage	CLOSED	
†WR2AEL	Bronx	147.84	147.24
†WR2ACO	Flushing	147.69	147.09
†WR2AFC	Hempstead	CLOSED	
*WR2AGC	Hudson	146.07	146.67
†WR2ABH	Huntington	CLOSED	
†WR2ABT	Huntington	CLOSED	
†WR2AFE	Manhattan	CLOSED	
†WR2ACC	Manhattan	146.07	146.67
†WR2AFG	Manorhaven	CLOSED	
†WR2ADZ	Nassau County	CLOSED	
*WR2AGH	Oswego	146.16	146.76
†WR2ACB	Stonybrook	CLOSED	

NORTH CAROLINA

†WR4AKB	Manteo	146.34	146.94
*WR4AJX	Union City T1800	147.24	147.90

OHIO

*WR8AFG	Clermont County	146.28	146.88
†WR8ADB	Millersburg	146.07	146.67

OKLAHOMA

*WR5AGI	Altus	146.19	146.79

OREGON

*WR7ADJ	Pendleton	146.28	146.88

PENNSYLVANIA

*WR3	Canton	147.75	147.15
*WR3ADW	Indiana	146.31	146.91
*WR3	Whitehall	145.645	145.045
*WR3DEE	Williamsport	146.13	146.73

SOUTH CAROLINA

*WR4	Greenville	146.22	146.82
*WR4AJO	Rock Hill	146.43	147.03

TEXAS

*WR5AGE	Alice	CLOSED	
*WR5AGF	Kingsville (RTTY)	449.00	444.00

VIRGINIA

D–WR4ABR	Arlington	146.31	146.91
†WR4ADZ	Blue Mountain	146.37	146.97
†WR4ACN	Chesapeake/Norfolk	146.19	146.79
*WR4	New Market	147.93	147.03
†WR4AHT	Roanoke	146.34	146.94
*WR4AHT	Roanoke	447.75	443.75
*WR4	Suffolk	146.40	147.00
*WR4ABR	Tysons Corner	146.31	146.91
*WR4AEY	Tysons Corner	222.34	223.94
O–WR4AEY	Vienna	222.34	223.94
†WR4AGT	Winchester	146.22	146.82

WASHINGTON

*WR7ADX	Mission Ridge	146.07	146.67

CANADA

BRITISH COLUMBIA

†VE7KAR	Kamloops	146.34	146.94

NEW BRUNSWICK

D–VE1PD	Fredericton	147.80	144.225

NOVA SCOTIA

D–VE1ATN	Charlottetown	146.10	51.515

ONTARIO

*VE3MHZ	Brampton	146.28	146.88
†VE3SSM	Sault Ste Marie	148.34/146.46	146.94
†VE3TFM	Toronto	222.38	222.98
†VE3UKW	Toronto	449.40	444.00

PRINCE EDWARD ISLAND

†VE1ATN	Charlottetown	146.10	51.525

QUEBEC

†VE2SP	Alma	146.34	146.94
†VE2IU	Chicoutimi	146.16	146.76
*VE2CRA	Hull-Ottawa	443.3	448.3
†VE2AMN	Joliette	146.43	147.03
D–VE2ASU	N.D. du Buckland	146.70	147.60
*VE2UZ	Quebec	146.46	147.06
†VE2NY	Riviere du Loup	146.46	147.06
†VE2SS	Sherbrooke	146.52	147.50
*VE2CRT	Three Rivers	146.46	146.94
†VE2AT	Trois Rivieres	146.07	146.67

FOREIGN

ISRAEL

*4X4	Jerusalem	145.175	145.775

SWEDEN

*SK0	Skelleftea	145.10	145.70

DENMARK

†OZ3REJ	Ringsted	145.05	145.65

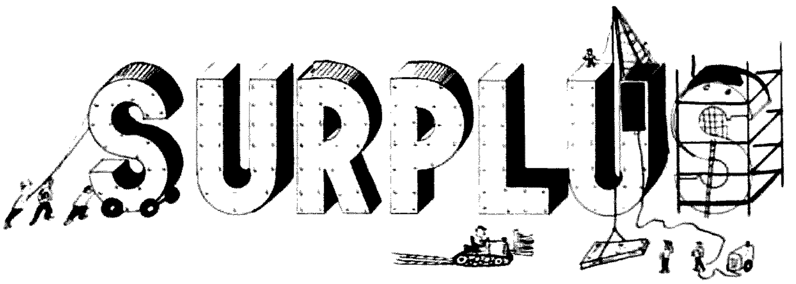
NEW ZEALAND

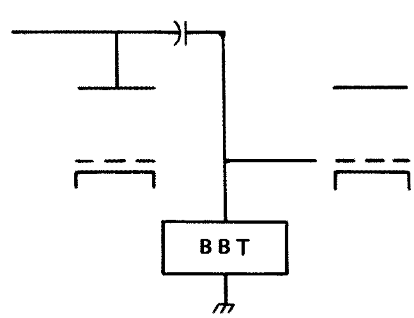
*ZL	Auckland	146.35	145.65
*ZL	Palmerston North	146.35	145.65
*ZL	Waikato	146.35	145.65
*ZL	Whangarei	146.35	145.65

AUSTRIA

*OE	Gmundnerberg	145.05	145.75
*OE	Kaiserkogel	145.10	145.70
†OE7	Klagenfurt	145.10	145.70
*OE	Krippenstein	145.125	145.725
†OE7	Kufstein	145.125	145.725
†OE5XLL	Linz	145.15	145.75
*OE	Patscherkofel	145.050	145.650

. . . WB4RVH





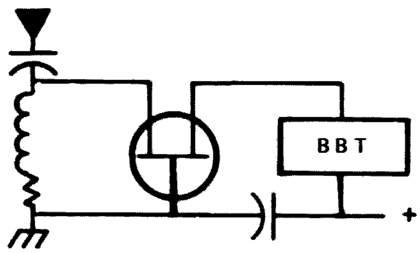
Interstage

Bill Turner WAØABI
Associate 73

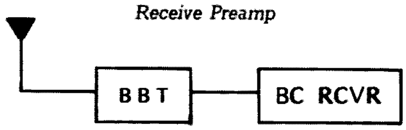
One of the more interesting items on the surplus market these days is a "broadband tuner," stock number RT-45, offered by Fair Radio Sales Co. Inc., 1016 East Eureka Street, P.O. Box 1105, Lima Ohio 45802. This item is stated as covering 14 to 50 MHz, but slight modifications in the form of adding shunt capacitance or rewinding the coil would allow coverage of about any HF/VHF frequency range you might need. As received, the unit is enclosed in a nice aluminum box measuring approximately 2" x 3" x 4" (50 x 75 x 100mm). The lower half contains an octal socket (intended for a 6SG7) along with an assortment of resistors, capacitors and chokes. A few minutes with screwdriver, soldering iron and hacksaw will reduce the 100mm dimension to about 60mm if space is critical.

Electrically this tuner is an ordinary parallel tuned circuit but mechanically it is definitely something else. The double bearing, 150 pF capacitor's rear shaft is extended approximately 40mm and is fitted with a 30mm diameter drum which is provided with a spiral slot. A pin rides in this slot and drives the ferrite slug of a 3/8" (9mm) coil mounted parallel to and below the capacitor shaft. As the capacitor shaft is rotated clockwise the plates unmesh and simultaneously the core is withdrawn from the coil. This combined action decreases both the inductance and capacitance and allows the tuned circuit to cover a much greater frequency range than would normally be possible.

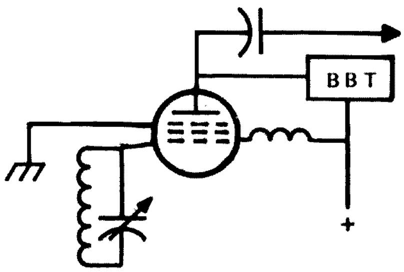
There are any number of uses to which this tuned circuit could be adapted. The original intent was to use it for a general coverage converter for a ham band only receiver but so many other uses have come to mind that I have bought several more to allow experimentation. The following may give you a few ideas of what you can do with this $1.95 item.



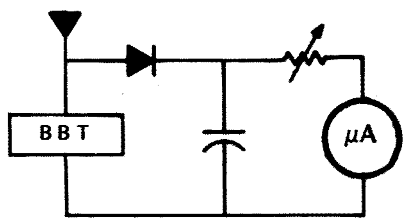
Receive Preamp



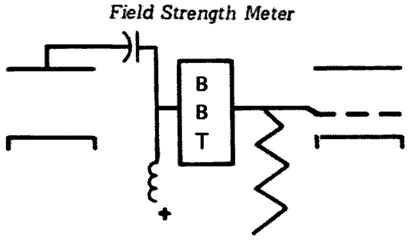
BCI Trap



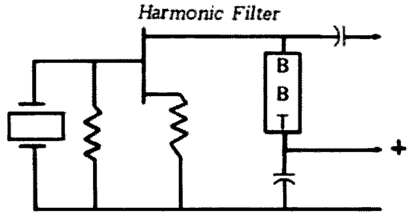
Harmonic Selector



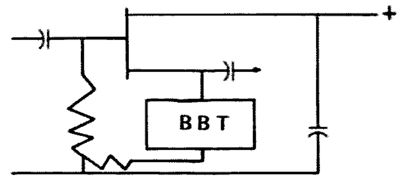
Field Strength Meter



Harmonic Filter



Band Edge Marker



Source Follower

Tri-Tek, Inc., P.O. Box 14206, Phoenix AZ 85031 has various items of interest to the builder, here are a few from their latest flyer. Round TO-5 transistor sockets, 14/$1; Sprague or Mallory electrolytics, 36,000 Mfd/15 V, $2.25 or 720 Mfd/150 V, $1.25. Miniature PC mount air variables 1.7-20 pF, 55¢; TO-3 mounting kit, all nylon, 10/$1; 8.3 Volt Zeners (1 W) use with a silicon transistor for 9 V supply 4/$1; NE-2 neons, 14/$1; red anodized TO-5 heatsinks, the good extruded type, 10/$1. How about ¼" x 1" (6 x 25mm) ferrite core choke (and coil) forms at 6/50¢? Building a time base or calibrator . . . could you use a 5.0000 MHz crystal made by Hughes . . . for $1.50? Need a transformer for a heavy duty power supply? Tri-Tek has one for $9.50 which will fill your requirements. These are brand new, fully jacketed and have 6 secondary windings, each rated at 6.4 V. Two are rated at 5 A and 4 at 2 A. By connecting these in series and/or parallel you can get from 6 V at 18 A to 38 V at 2 A . . . and many steps in between. Olson Electronics, 260 S. Forge, Akron, Ohio 44327 has some items of interest too. The current flyer lists a 12 V dc, 3 A power supply kit for $7.99 (normally $9.95) including the chassis, transformer, filter etc. Sounds like just the thing for the 2 meter rig. Also listed are a variety of meters including 0-1 mA, 0-150 uA and 75-0-75 uA each for under a dollar. For the linear builder Olson lists a 160cfm blower "used but works like new," for $3.99. These are 5¼" (130mm) diameter and are of the torrington variety.

. . .WAØABI

AMSAT NEWS

OSCAR 7

The satellite continues to do a splendid job. Mode A is operative on odd days and mode B on even days. Don't use it on Wednesdays please. It's on, but should be left alone.

A little rf interference has developed on a few of the telemetry channels (1A-2D).

The space-only on-off RTTY function is a normal one, but unpublicized previously. Please send in reports of TT contacts via this mode.

The 2m-10m signals have been heard from way over the horizon by several English ops and East Coast ops are asked to particularly keep an ear peeled for any European signals coming through on over the horizon passes. Reports on this will be appreciated.

The Oscar 7 QSLs are now being sent to those who furnish reports.

A German op heard a Spanish station coming through the 70/2m link and further information on this is hoped for soon.

Oscar 6 continues to work well and G3IOR reports that he has now made contact with 50 countries via the satellite! Amsat reports 87 countries so far reported via Oscar 6 and nearly 3000 users.

There are three new Amsat nets. One on Saturdays at 1000z on 14280, one on Sundays at 1015z on 3780, and one in London with net control G8CSI on 144.28 at 1730z.

Amsat reports that it has sent out a list of the predicted orbits for both satellites to everyone on their mailing list, complete with a list of some of the accomplishments so far. They also report that reprints are available of some of the tech articles from the Amsat bulletin with good info on equipment to use, modifications of equipment, and how to work through the satellites.

HR report erroneously said Amsat had some slides of the project – these are available, but from ARRL, not Amsat.

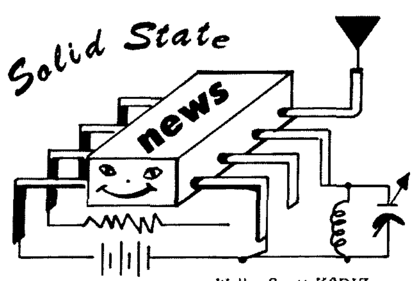
The mailing address for Amsat is: Amsat, P.O. Box 27, Washington DC 20044.

OSCAR 6 ORBITING DATA

A little study of these figures should allow extrapolation of times for future dates.

Orbital Information

Orbit	Date (Feb)	Time (GMT)	Longitude of Eq. Crossing °W
10498	1	0042.5	59.1
10511	2	0137.4	72.8
10523	3	0037.4	57.8
10536	4	0132.3	71.5
10548	5	0032.2	56.5
10561	6	0127.2	70.2
10573	7	0027.1	55.2
10586	8	0122.0	69.0
10598	9	0021.9	53.9
10611	10	0116.9	67.7
10623	11	0016.8	52.7
10636	12	0111.7	66.4
10648	13	0011.7	51.4
10661	14	0106.6	65.1
10673	15	0006.5	50.1



Waller Scott K8DIZ
7318 Hollywood Drive
West Chester OH 45069

Voltage regulators are required in many solid state circuits today to compensate for the effects of varying line voltages. Also, regulators allow use of power supplies with poor load regulations for non-critical parts of a circuit, and the addition of regulation to only those portions requiring a stable power source. Regulators with built-in short circuit protection provide some protection for the main power supply as well as the load circuit.

A very useful series of ICs has been introduced by Fairchild. This is the 78L00 series of 3-terminal positive voltage regulators. These regulators employ internal current limiting and thermal shutdown, making them essentially indestructible. If adequate heat sinking is provided, they can deliver up to 100 mA output current. They are intended as fixed voltage regulators in a wide range of applications including test equipment, on-board regulation for elimination of noise, solving distribution problems associated with single point regulation, and general purpose power supply use. In addition, they can be used with power pass elements to make high current voltage regulators. The 78L00 used as a zener diode/resistor combination replacement, offers an effective output impedance improvement of two orders of magnitude, along witn lower current.

Typical output voltage change is 1% with input voltage variations, and 1% with from 5 mA to 100 mA load current variation. Available output voltages are 2.6, 5, 6.2, 12, and 15 V dc. The units are available in either ± 5% or ± 10% voltage tolerances. Maximum input voltage is 30 V except for the 12 and 15 V devices which are rated at 35 V dc.

The superiority of the 78L00 compared to the standard 400 or 500 mW zener (1N746 or 1N5221 series) is shown in Fig. 1. The resistor/zener combination can supply a load current of 17 mA with a quiescent current of 20 mA, while the 78L00 can couple up to 100 mA of load current with a quiescent current of 5 mA. At 5 mA the temperature coefficient of the 78L00 output voltage is equal to or better than the zener and output noise voltage is reduced when using the 78L00 series.

This regulator is available in a TO-39 metal and the more common TO-92 plastic package. The 3-lead plastic package is available from your Fairchild distributor as the 78L12WC (12 V version – last digits indicate voltage and tolerance) for $.75 in single quantities.

For higher current requirements, Motorola has a series of 3-terminal voltage regulators for both positive (MC7800C series) and negative voltages (MC7900C series). The 7800 series of fixed positive regulators is available in voltages of 5, 6, 8, 12, 15, 18, and 24 V. The 7900 series is

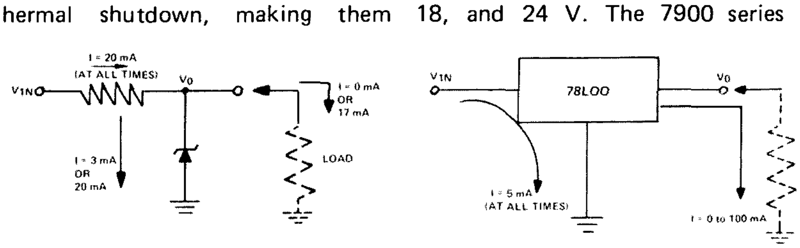
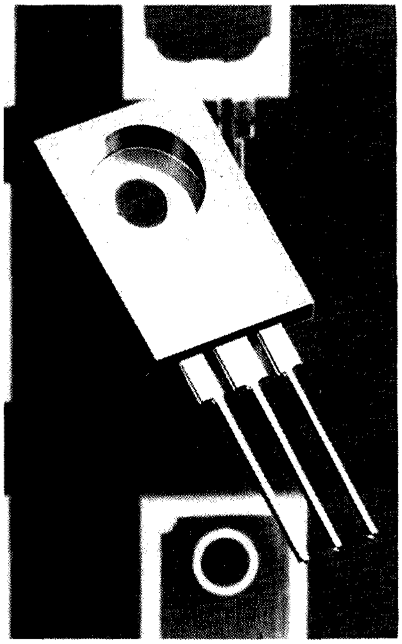


Fig. 1. Regulator Comparison



MC7800 & MC7900 Regulators

available in the same negative voltages with the addition of -2 and -5.2 Vdc. The current rating of these regulators with adequate heat sinking is 1.0 A. They employ both current limiting and thermal shutdown circuits built on the chip itself. These circuits can be used with external pass transistors to obtain even higher output currents. Each of the regulator series will accept a maximum input voltage of 35 Vdc except for the 24 V versions which safely accept up to 40 V. The simplicity of the 3-terminal high current regulator permits you to locate regulated power supplies exactly where they are needed avoiding long runs of power leads. The regulator circuit becomes very small and compact compared to the normal discrete parts version. Normally, no external components are required. The 3-pin package shown in the photo is designed for easy mounting to a heat sink to allow the greatest power dissipation rating.

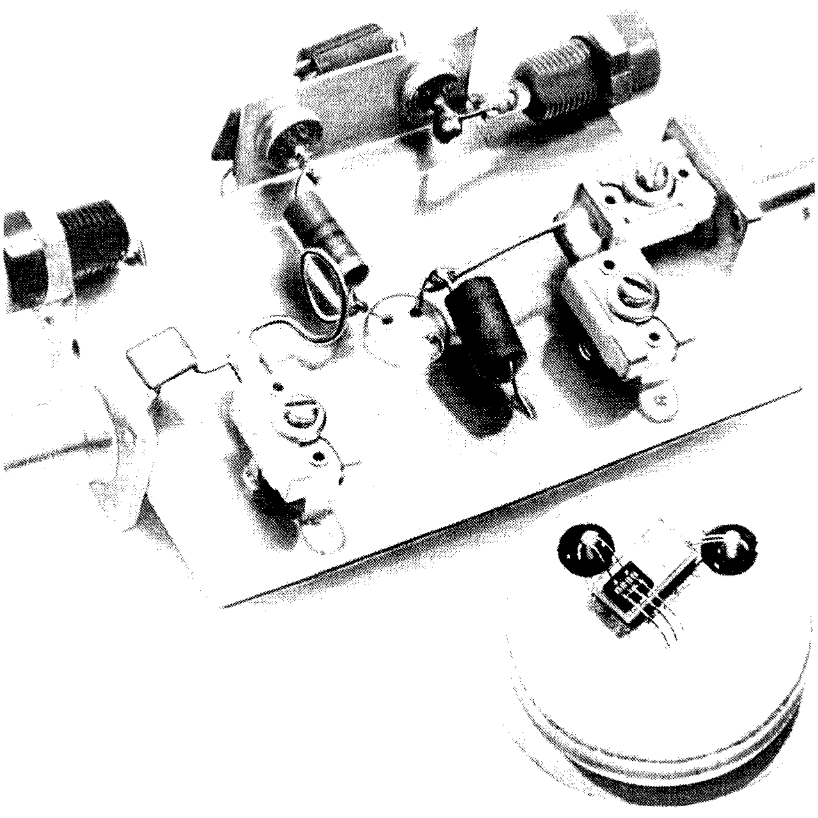
The positive MC7812CP (12 V) can be obtained from your Motorola distributor for $2.20 and the MC7912CP negative (-12 V) for $4.15 in single quantities.

Motorola has introduced a major package innovation to the rf power industry. The MRF227 contains a unique beryllia-insulated die mounting technique used to significantly improve the power dissipation and gain of the standard TO-39 style package. These improvements enable a designer to replace expensive stud mounted, medium power devices, in rf applications, with a low cost alternative. Resultant price savings of 2 to 1 over stud mounted devices are achieved.

This package innovation enables the use of the TO-39 style at medium power levels. By mounting the transistor die on a beryllia insulator, the collector is electrically isolated while still allowing heat to be conducted to the case header. The photo shows an enlarged view of the die and insulator mounted on a TO-39 header as well as a 220 MHz amplifier test circuit.

The emitter is connected directly to the case which is soldered to circuit ground; this provides lower emitter inductance and reduced parasitics in the common emitter configuration. In a typical installation, as shown in the photo, the device is mounted directly to a heat sink or the case of the equipment. No more insulating washers and associated mounting hardware!

Compared to stud mounted devices, where the collector is tied to the case for thermal reasons, this new technique can provide improved performance. A typical stud configuration requires bond wires from the transistor die to a substrate solder bridge. The bridge is connected to package leads and these leads are then soldered to the circuit. The beryllia insulated die mounting technique offers a lower cost part.



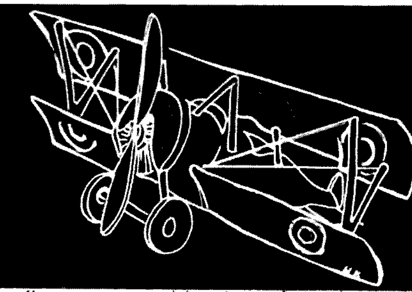
MRF227, 220 MHz Power Transistor

The MRF227 is the first device available from Motorola using this new mounting method. This device and new packaging technique was originally developed for the proposed class E CB section of 220. We all hope that this great development never finds its way into that type of equipment (and that the FCC leaves 220 as it is), but instead into the final or driver slots of homebrew or commercial 220 portable and mobile FM gear for ham use.

The MRF 227 is conservatively rated at 3 W with a power gain of 13.5 dB minimum and an efficiency of 60%. Two more devices are expected to follow the MRF227. They are the MRF237, a VHF driver, and the MRF629, a UHF driver. More on these as info becomes available.

The unit price of the MRF227 is $2.50 (not bad eh, for a VHF power transistor?) and down to $2.00 for those who can find a use for 100 of them! This transistor could really start off an interest in building for a band that needs our attention and participation. Remember – 220, USE IT OR LOSE IT!!!

Autobiography of an Ancient Aviator



W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230

One of the more pleasant things about publishing 73 Magazine has been the considerably above average intelligence of the readers — an intelligence which has allowed them to be interested in a wide range of things in addition to our mutual bond of amateur radio. Each excursion into non-ham subjects has brought a volley of thoughtful letters from readers — plus an occasional brickbat, for there are a few hams who don't want to know nothin' about nothin' but ham radio.

Since a high percentage of amateurs are also pilots, it seems obvious that there must be some similarity in the personality defects which draw men into these hobbies. So, starting with this issue we will be running a series on the beginnings of aviation in this country, written by a man who was there when it started — who had commercial flying license number 73 — who knew Lindberg and Amelia Earhart personally — who helped start one of the first transatlantic airlines — and who was one of the early barnstormers. . . .Wayne

FIRST ALLUREMENT

The time: Just after sunrise on a bright sunny morning in July 1914.
The place: A newly mown meadow on the Lisbon Road just below Littleton, N.H.
The Event: First test flight of a locally home made aircraft.

John Woods, a Littleton boy, had bought plans, specifications, some materials and a small engine for a single Wright type pusher biplane. During the previous winter and spring he had built the wings, control surfaces and other parts of the machine in his barn, mostly by himself. He had finished final assembly and rigging of the machine and had run up his engine the afternoon before. However, he put off his test flight until the next morning when the early morning air would be more dense and would give his wings more lift.

The machine had a pilot's seat in the center of the lower wing with controls for engine, elevators, rudders and wing warping. Since this aircraft was designed before the invention of ailerons, a combination of rudder and warping of the wings was used for banking and turning flight. As I remember, it had no wheels but used skids instead.

When all was ready John got two of us to stand at each wing tip to hold the machine back while he rev'd up the engine. Then he had another fellow pull the propeller through to start the engine. After a few tries the engine started and appeared to be running satisfactorily. Then, at a wave of John's hand, the four wing men started the machine forward and let go.

The craft gathered speed and, after going about 100 feet, left the ground and had gained about two feet altitude when a small rise in the meadow proved to be an insurmountable object. The craft was travelling at a speed of about forty miles per hour when it hit the knoll. The frail stick and wire construction collapsed and the machine was shattered beyond repair. In those days the wing struts were not bolted in but were held in place by the flying and landing wire rigging.

John Woods' injuries were quite superficial — only a few bumps and scratches. We helped him gather up the pieces and load them on his truck. Later he told me that he had decided not to try to rebuild the machine and that, although he was determined to learn to fly, he was going to wait until a more airworthy and less fragile craft was available.

This is how my interest in aeronautics and desire to fly began.

About fifteen years later I met John at the Philadelphia Naval Air station where we spent several hours talking about what each had been doing since 1914. John was then a test pilot for an aircraft engine company. Only the day before it had been necessary for him to bail out of a plane with an experimental engine he was testing when the engine blew up. I was investigating the accident. Our paths haven't crossed since then.

NEXT EXPOSURE

The first World War came along and I was kept busy as an Infantry 2nd Lieutenant until I was discharged in June 1919. I returned to Littleton with the idea of taking the rest of the summer to demilitarize myself, do a little fishing and prepare for the next phase of my life. Two or three weeks after my return Bob Fogg arrived in Bethlehem in his Curtiss OX-5 Jenny. He was carrying one passenger at a time from a hillside field on Lewis Hill. I was interested enough to pay him $5 each for three ten minute rides. By that time my mind was made up. I wanted to learn to fly as a start in the aviation business that I felt was sure to develop in a few years. If I had known then that it was going to be another ten years or more before aviation would amount to much as a business I might have made a different choice.

Since I was then a 2nd Lieutenant in the Army Infantry Reserve I thought I might be able to get the Army to put me on active duty assigned to the next Air Corps flying school class. However, when I got to Washington in the fall of 1919 I found that I was about the only one to which my plan appealed. So I went over to Bolling Field in Anacostia and asked some of the officers for their advice on how best to go about getting an appointment to the Air Corps Flying School. Their advice was to get as many letters as possible from the New Hampshire Senators and Representatives to the Chief of the Air Corps recommending me for appointment as a Flying Cadet. I finally got letters from both Senators and one Representative and delivered them together with an application to the office of the Chief of the Air Corps. I was told that it would take some time to process the application and that I would be notified of their decision. I then got one of the Senators who knew my father quite well to phone the Chief once in a while to inquire about my application.

Thus matters drifted on for a few months. I was back in Littleton when, in March, I received a letter from the Chief of the Air Corps requesting me to appear before a selection board at Bolling Field in April. This board would determine my fitness for appointment as a Flying Cadet. I appeared as requested, answered all of their questions and asked a few of my own. The decision of the board was to recommend my appointment provided I could pass their physical examination for flying. The next day I took the physical examination and passed

with no waivers. After this the board advised me that, since the 1920 class was full, they would enter my name for the class starting in Sept. 1921. Next month I'll tell you about the air primary and advanced flying schools.

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

WBØCHL writes that he is a convert to 6 meters and when he says convert, he means convert. Jim has converted an E. F. Johnson solid state SSB CB rig to 6 meters. The power out isn't too great at the moment, about 2 W PEP, but a 60 W solid state amplifier is in the works to make it competitive with the 6146 tube rigs. Jim hasn't had too much success "on the air" as yet but mentions openings from Northfield, MN on November 18th, 21st, 25th and 30th. I am sure everyone has read articles on converting CB rigs to 10 meters and even a few have been converted to 6 but to my knowledge this is the first SSB rig converted. Congratulations Jim.

K8DFR "Mac" writes from Lansing, Michigan to inquire about VHF Communications Magazine. For the benefit of those who don't know, this is the English language translation of the German VHF/UHF magazine UKW Berichte (Ultra Short Wave Report). Published quarterly for a subscription price of $5.75, this magazine is basically construction and features all size PC layouts of all projects or you may obtain parts kit and/or PC boards from the subscription representatives. The rep. for the east is VHF Communications, 915 North Main St., Jamestown, N.Y. 14701. Those in the central and west should contact Bob Eide WØENC, 53 St. Andrew, Rapid City, SD 57701.

While listening to the band trying to open to Fla. the evening of November 25 I heard WA4PXW working several stations. Signals were QSBing rather badly so I started tuning around a little. Up the band I heard a weak signal and stopped to listen, it turned out to be K7PXI from Phoenix. I immediately turned the beams from SE to SW only to find the signal had completely disappeared. After much beam swinging it was determined that Carl was weak but consistant with the beams SE with absolutely no copy to the SW. I listened as contacts were made in Texas, Oklahoma and (as I remember) Louisiana. All during this time WA4PXW could be heard occasionally but never for more than a few seconds at a time.

Forrest K4YPO telephoned just to say hello while on vacation in the area . . . KØKYZ/8 called to ask questions about the SBE SB-50, he is thinking of buying one . . . Yaesu planning to ship the first FT-620B's to dealers the third week in December, they should be available in quantity by now . . . WA4BDW has petitioned the FCC to require all Technician examinations be taken before the FCC or designated authority, a good idea I think . . . it would remove some of the stigma and at the same time make it simpler to study for the General. Did you see the excellent 50 MHz propagation article in Ham Radio's December issue or the 6 meter conversion for the SB-220 in December's QST?

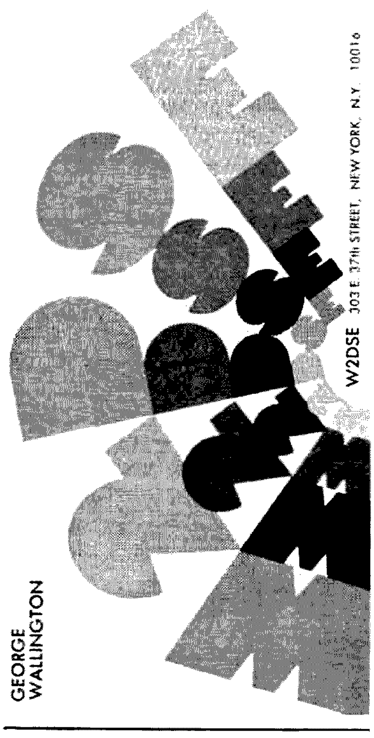
From Dallas WA5IKU mentions a number of openings: "Good to better on 11-17 – WB4LDO/4, WA9RDF, K8RZB, and many others . . . all good strong signals." Unusual opening 11-25, "worked WA4IMG and WB4YSE . . . band very noisy . . . tuned down around 50.085 . . . beam south . . . Spanish QSO on AM . . . very strong for a few minutes." By later postcard Perry mentions another opening 11-30 "band really opened up today. Heard Ø, 1, 4, 6, 20 to 30 over 9. Very good contact with WB5CNZ – Marty – New Mexico . . . great signal." Perry would like to hear from other hams who are postal employees; write him at 2240 Prichard Lane, Dallas, TX 75227.

Joe WB4OSN says the band has been rather dead in Florida but we did talk twice during the month and other later reports indicate an upturn late in the month.

By the time this appears in print 1975 will be well under way and it will be time to begin any projects which are to be completed before the spring DX season. If your rig needs to be overhauled, do it now. If you want that linear finished, you had better get underway. It isn't too early to start planning the antenna and tower modifications either. Plans here include a cathode driven single 4CX250B in a case to match the SB-50 and pulling down the time ravaged pair of 6 element Telrexs and installation of a single 8 element KLM along with raising the tower an additional 10 feet (3.6M).

. . .WAØABI

QSL CONTEST



There is no way to do justice to this month's winner on a black and white page. The colors are brilliant. Those that abut look gorgeous together and all the colors are balanced well, with careful consideration given not only to the letters which touch each other but the overall effect of the design, that the result is a terrific piece of op art. George wins the free one year subscription this month. Send in your entry to 73, QSL Contest, Peterborough, NH 03458.

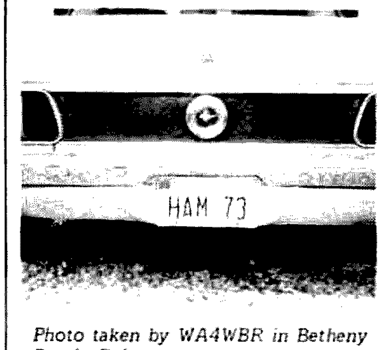


Photo taken by WA4WBR in Betheny Beack, Delaware.

FCC NEWS

DOCKET 19555 ORDER

Environmental docket released

While amateur radio is mentioned in this report and order only once — having to do with amateur earth stations for satellite use — the final rules would seem to have little impact on amateurs. DXers who want to put up towers over 300 feet high should start trying to decypher the fine print and make sure that they do not disturb Uncle. Repeater groups who intend to erect towers over 100 feet high for microwave relay are also advised to see if they can find someone to interpret the extensive order. Other than that, the rules changes would seem to have no relevance to amateurs. Somewhere along the line that bit about getting permission from neighbors before erecting ham towers got sidetracked —hallelujah! It's a good thing amateurs made an uproar over this . . . chalk up another win as proof that it really does pay to become involved in "fighting city hall."

FCC 74-1336
25225

Before the Federal Communications Commission, Washington, D.C. 20554
In the Matter of
Amendment of Part 97 of the Commission's Rules concerning operator classes, privileges and requirements in the Amateur Radio Service.

Docket No. 20282

RM-1016,	RM-1363,	RM-1454
RM-1456,	RM-1516,	RM-1521
RM-1526,	RM-1535,	RM-1568
RM-1572,	RM-1602,	RM-1615
RM-1629,	RM-1633,	RM-1656
RM-1724,	RM-1793,	RM-1805
RM-1841,	RM-1920,	RM-1947
RM-1976,	RM-1991,	RM-2030
RM-2043,	RM-2053,	RM-2149
RM-2150,	RM-2162,	RM-2166
RM-2216,	RM-2219,	RM-2256
RM-2284,	RM-2449	

NOTICE OF PROPOSED RULE MAKING

Adopted: December 4, 1974;
Released: December 16, 1974
By the Commission: Commissioner Quello absent.

1. The Commission has before it the above listed petitions (also listed in more detail in Appendix I) for rulemaking. Principally, petitioners are seeking amendment to the Rules for the Amateur Radio Service regarding operator classes, requirements, and privileges. Some desire additional privileges for only one specific operator license class, or desire lower requirements for one specific class. Others want more extensive amendments, such as the deletion, or addition, of an entire license class. Some would establish a new "Hobby" operator license class, having no telegraphy skill requirement. Of these, RM-1841, RM-1991, and RM-2053 would have this operator class in the Citizens Radio Service. Since operation of a radio station as a hobby or diversion, i.e., an activity in and of itself 1/, is prohibited in the Citizens Radio Service, we consider such operation to be one more suitable to the Amateur Radio Service. Thus, these three petitions are included in this proceeding. RM-1633, RM-1656, RM-1793, and RM-1841 are also included in Docket 19759, but will be considered herein to the extent applicable. Additionally, petitions RM-1947 and RM-2256 contain proposals otherwise pertaining to operator privileges and are included herein for that reason.

2. RM-1629 relates to the possibility for conducting operator examinations at places other than regular Commission examination points by persons other than Commission employees. Since the entire matter of amateur radio operator examinations will be under consideration in this proceeding, it is also incorporated.

3. The type of amendments requested by the petitioners cover a broad scope of thoughts and ideas. In summary, the salient requests are:

a. Authorize some, or all, Novice Class privileges to the Technician Class.
b. Permit a person to hold both a Novice Class license and a Technician Class license.
c. Authorize some privileges in the 144-148 MHz frequency band to the Novice Class.
d. Authorize all of the 144-148 MHz frequency band to the Technician Class.
e. Authorize some privileges in the 28-29.7 MHz frequency band to the Technician Class.
f. Reallocate the frequency subbands among the various license classes.
g. Establish new frequency subbands for incentive purposes in the 1800-2000 kHz band.
h. Authorize Amateur Extra Class operator privileges to Advanced Class operators.
i. Limit transmitter power privileges for General Class operators to 250 watts on the 3.5 MHz, 7.0 MHz and 14.0 MHz frequency bands.
j. Limit transmitter power privileges for all operator classes to 300 watts on amateur frequency bands below 30 MHz.
k. Specify maximum transmitter power in terms of output.
l. Establish a new Hobby Class license, or a new VHF Telephony Class license having no telegraphy requirements or privileges.
m. Establish a new Beginner Class and a new Code Class of operator licenses.
n. Combine the Novice Class license and the Technician Class license into a new VHF Telephony Class.
o. Establish a new Intermediate Class license and a new Communicator Class license.
p. Establish a new Advanced Technician or First Class Technician Class license.
q. Discontinue the Conditional Class and Technician Class operator license.
r. Issue the Amateur Extra Class operator license for life.
s. Reduce Element 1(B) telegraphy requirement from 13 words per minute to 10 words per minute.

Obviously, we cannot accommodate all of these requests because some are in conflict with others. We do not believe it is desirable to deal with these petitions on a piecemeal basis, since many are interrelated. Accordingly, we conclude the time is propitious for a review of our entire amateur licensing structure. To this end, we have reviewed the petitions carefully, together with the existing system of operator privileges and requirements, against the fundamental basis and purpose of the Amateur Radio Service. The following represents our best forecast of the direction we should move in this matter.

4. We recognize the desire by some amateurs, and would be amateurs, as expressed in RM-1633, RM-1793, and RM-1976, for a class of amateur oper-

1/ See §95.83(a)(1).

ator license having requirements that do not include a knowledge of telegraphy. Although every amateur radio operator license has traditionally required the applicant to demonstrate some level of proficiency in International Morse Code, goals within the basis and purpose of the Service could be met, at least in part, without this requirement. Moreover, as several of the petitioners point out, the International Radio Regulations do allow the Commission to waive the requirement for an amateur to "...have proved that he is able to send correctly by hand and to receive correctly by ear, texts in Morse code signals..." 2/ in the case of stations only operated above 144 MHz. A survey and analysis 3/ conducted in 1971 indicated that there may be as many non-licensees interested in amateur radio activities, if not more, than there are persons already licensed in the Amateur Radio Service. The most often mentioned reason for not obtaining an amateur license is the telegraphy requirements. We are aware the need for, and the use of, telegraphy in amateur radio communications is much less on amateur frequency bands above 50 MHz than it is on the amateur frequency bands in the High Frequency (3-30 MHz) and Medium Frequency (.3-3 MHz) range, where spectrum conservation, tolerance to interference, and other factors, make telegraphy an important mode of amateur radio-communication. We believe, under carefully established provisions, a new "telephony-only" type of operator license, limited to frequencies above 144 MHz, could and should be incorporated into the Amateur Radio Service.

5. The present operator license structure is shown in Figure 1. For all intents and purposes there are ten classes of operator licenses available in five ascending levels of operator privileges. Qualification for an operator license is established by means of the various examination elements shown in Figure 1. These may be administered either by a Commission examiner or by a volunteer examiner through the mail examination system. The Amateur Extra (C) Class, the Advanced (C) Class, and the Conditional (P) Class licenses are issued to physically disabled applicants qualifying on the basis of a mail examination administered by a volunteer. The Conditional Class license is issued to applicants qualifying on the basis of a mail examination administered by a volunteer, because of distance or other unusual difficulty in appearing at a regular examination point. The Technician (C) Class and Novice Class licenses are issued to applicants qualifying on the basis of a mail examination administered by a volunteer, the normal procedure for these license classes. Except for the Novice Class license and the Conditional Class license, the absence of the designator (C) or (P) following the operator class on the license means the licensee has qualified before a Commission examiner, and is not subject to re-examination. Any licensee qualifying on the basis of mail examination may be required by the Commission to appear before a Commission designated examiner for re-examination. Periodically, a sample number of licensees who have obtained their licenses on the basis of a mail examination are selected at random and asked to appear in order to verify the validity of the mail examination system. Those who do not appear, and those who do not pass the re-examination, are subject to license cancellation.

6. The privileges associated with each operator license class are intended to provide the necessary incentives for amateurs to upgrade their skills. This system has been largely responsible for thousands of amateurs to upgrade, particularly to Advanced Class and to Amateur Extra Class. The current number of operators in each

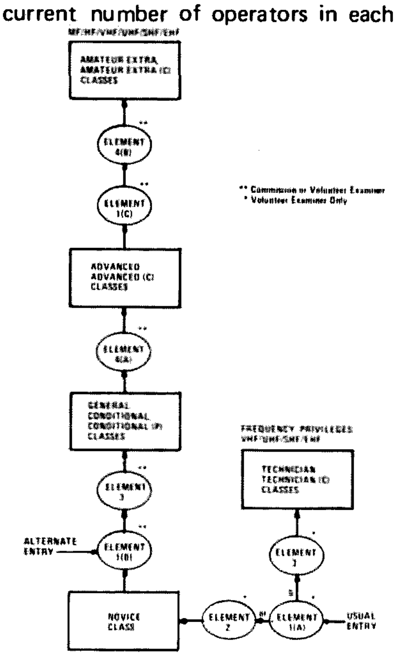


Fig. 1. Present structure of operator license classes, examination elements and frequency privileges.

license class is shown in Figure 2. While it is gratifying to see even the limited success of this system toward fulfilling the basis and purpose of the Amateur Radio Service, it is a desirable goal for most amateurs to reach a higher operator class, say the Advanced Class, or even the Amateur Extra Class. 4/

7. An inherent principle in arriving at any new licensing system is a logical relationship between the qualification requirements and the operator privileges authorized at each license class level. For instance, it would not be rational to require an applicant to demonstrate a certain specific proficiency in order to qualify for a particular operator license class which authorized no corresponding privileges requiring that proficiency. Conversely, an operator license class should not authorize significantly more privileges than the requirements for that license class reasonably justify. While we believe there are the means available within the Amateur Service to satisfy the reasonable needs of most United States citizens having a genuine interest in pursuing radio activities within the basis and purpose of the Service, there are basic limitations brought about by practical realities. For example, the vast array of interests and levels of ability among amateurs must be provided for within a fixed number of different operator license classes. The resources available to the Commission for regulating the Service are not unlimited. Issuing licenses, preparing and conducting examinations, monitoring the frequencies, enforcing the regulations, etc., are all activities that must be provided by the Commission. In this proceeding, we are moving on the assumption the amateurs' record of cooperation and assistance will continue in the future, and an unduly large increase in the Commission's workload will not be necessary.

8. We are proposing in this pro-

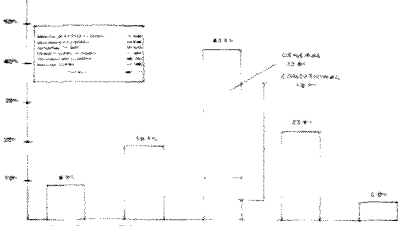


Fig. 2. Percentage of amateur licenses in each class, May, 1974.

2/ Radio Regulation Annexed to the International Telecommunication Convention (Geneva, 1959) Article 41, Section 3(1).

3/ A Survey and Analysis of the Citizens Radio Service, P.B. — 204 595.

4/ §97.1(c) states as one of the principles expressing a fundamental purpose of the Amateur Radio Service: "Encouragement and improvement of the Amateur Radio Service through the rules which provide for advancing skills in both the communication and technical phases of the art."

ceeding to establish a new *Communicator Class* operator license, having no telegraphy requirements nor privileges. Operation under this license would be limited in a manner similar to that of the current Novice Class, except frequency privileges would be above 144 MHz. The objective would be to enable beginners to enter the Amateur Radio Service and, through the experience gained by operation of low-power radiotelephony station, develop the necessary interest and skill to qualify for higher class operator licenses.

9. Those petitions calling for another new operator license class above the current Technician Class raise significant questions regarding the scope of the Technician Class as presently constituted. For example, in RM-1535, the American Radio Relay League (ARRL) states:

> "It is readily apparent from the various pronouncements of the Commission over the years and from the present interests and operations of Technician Class licenses that the purposes for which the Technician Class was established . . . require review. It is respectfully suggested that any Notice of Proposed Rule Making invite comments and suggestions for major revisions of the Technician Class license . . . In numerous disasters . . . including the Alaskan earthquake in 1964 and the recent Hurricane Camille, the contributions of Technicians in providing internal communications have been valuable beyond estimation. Participation by Technicians in the League's Amateur Radio Emergency Corps (AREC) has grown over the years. The evolution of Technicians as communicators as well as experimenters . . . since the class was established must be recognized."

Although interest in the communication aspects of amateur radio has emerged among the some 49,000 Technician Class licensees, apparently they are not sufficiently persuaded by the additional communication privileges in the High Frequency (HF) and Medium Frequency (MF) amateur bands afforded to General Class licensees to the extent of increasing their telegraphy skill from 5 words to 13 words per minute, the only real difference in qualification between the two license classes. The needs and interests of this group probably are fully satisfied by the operation of an amateur radio station in the VHF (Very-high Frequency) regions and above. Accordingly, we can conclude technological and operational developments by amateurs in the VHF, and possibly in the UHF (Ultra-high Frequency) bands, have reached the point where the interest to amateurs is comparable to, if not already exceeding, that in the MF and HF "shortwave" bands. Therefore, in order to provide meaningful incentives for amateurs interested in this part of the radio spectrum to upgrade their skills, the incentive principles should also be applied for these bands similar to those now in effect in the shortwave bands. A new higher class operator license comparable in requirements and privileges to the Advanced Class, except based upon operation above 29 MHz, may be desirable. Obviously, for this new higher class license, any additional telegraphy skill is not meaningful since telegraphy is not a major communication mode in these frequency bands. However, other modes, such as television, remote control, facsimile, repeaters etc., are very meaningful, and need to be emphasized. Therefore, we are proposing another new operator class license, the *Experimenter Class*, as the means toward fulfilling these needs.

10. We have examined several possible revised operator license class structures in a search for the best way to incorporate the proposed Communicator Class and the proposed Experimenter Class licenses. As broad objectives, we desire to 1) preclude, or at least minimize, any adverse impact upon presently licensed amateurs, 2) closely relate requirements to privileges for each license class, 3) provide realistic upgrading steps and incentives, 4) provide the opportunity and flexibility for persons interested only in shortwave radio, or only in VHF and above, or interested in both, to obtain a license and pursue their particular interests. As a result, the structure we are proposing is shown in Figure 3, and the specific proposed rule amendments are given in Appendix II. In general, we favor this structure because it seems to more fully reflect our objectives and to satisfy most of the objectives of petitioners. Two series of operator license would be offered, Series A and Series B. Amateurs would be permitted to hold *one* operator license permitting privileges in one or both series. For example, an amateur could hold an operator license authorizing Novice Class privileges in Series A and also Technician Class privileges in Series B, a request asked for by several petitioners. Operator licenses in Series A would authorize only privileges on amateur frequencies below 29 MHz, and operator licenses in Series B would authorize only privileges on amateur frequencies above 29 MHz. Operator licenses would normally be issued for a 5 year renewable term, including the Communicator Class and the Novice Class in order to compensate for any increased administrative burdens resulting from the proposed amendments. (Novice Class licenses are currently issued on a 2 year, non-renewable basis, no filing fee). Section 303(L)(1) of the Communications Act of 1934 does allow us to issue operator licenses for life, as requested for the Amateur Extra Class in RM-2030. Under our current rules, the operator license 5/ is always combined with the Primary station license which cannot be granted for a term longer than 5 years, a requirement of Section 307(d) of the Act. We are proposing to adept the request. Our records indicate very few amateurs drop out of amateur radio after they have attained the Amateur Extra Class. The licensee would still be required to renew his station license(s) every five years, so in effect, this proposed rule would amount to eliminating the need to retake the examinations should the amateur neglect to renew his license.

11. Under the proposed license class structure, new Advanced Class licenses and General Class licenses

5/ Although large certificates are awarded to Amateur Extra Class licensees upon request, the certificates do not satisfy the availability requirements of §97.83.

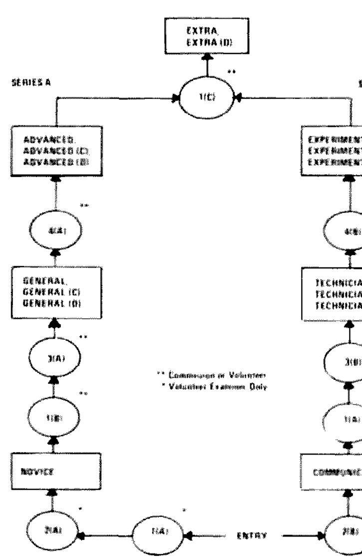


Fig. 3. Proposed revised structure of operator license classes and examination elements.

would no longer carry requirements and privileges above 29 MHz. The Experimenter Class and the Technician Class would be the counterpart operator licenses in Series B, and would not carry any requirements and privileges in Series A frequency bands. The Current Amateur Extra Class would be shortened in name to Extra Class, and would authorize full amateur privileges in both series. We are proposing to discontinue the written examination and the exclusive telephony segments available only to this class. The material in the current Element 4(B) examination required for Amateur Extra Class would be combined with the material for the current Advanced Class Element 4(A) and, together with other new material, be used in new examination Elements 4(A) and 4(B) for the Advanced Class and Experimenter Class respectively. Material related to the shortwave domain would be used in 4(A) and material related to the other domains would be used in 4(B). After obtaining both the Advanced Class and Experimenter Class, an amateur would then only need pass the Element 1(C) 20 word per minute telegraphy examination to qualify for the Extra Class. Because of this additional telegraphy requirement, the Extra Class would continue to have exclusive telegraphy subband privileges.

12. Under the proposed license structure, every currently licensed amateur radio operator would automatically be eligible to renew upon application, his current operator license to include privileges in at least one, and in most cases both series without further examination. Table 1 illustrates the highest class, or classes, of operator license that could be obtained without further examination.

13. Both of the proposed license series would be based upon three levels of difficulty: a beginner level, an intermediate level, and an advanced level. Ideally, this type of system would offer a newcomer the opportunity to enter the Amateur Radio Service at the beginner level with a minimum of proficiency, gain the experience and practical knowledge necessary to qualify for the intermediate level, and then move on to the advanced level. The privileges authorized at both the beginner and intermediate levels would be only those necessary to provide the desired experience for upgrading. Similarly, the related qualification requirements would be only the minimum necessary to insure that the licensee understands the privileges, limitations, and responsibilities associated with the license, with particular emphasis on methods for properly evaluating emissions of the type(s) authorized by the license.

14. We are proposing three principle areas of operator privileges: operating frequencies, emissions, and maximum transmitter power. For Series A, the authorized frequency bands would be basically the same as at the present below 29 MHz, except the exclusive telephony segments reserved to the Amateur Extra Class would be also available to the Advanced Class. In Series B, the Technician Class would be authorized all amateur frequencies above 50 MHz, thus gaining additional frequencies 50.0-50.1 MHz and 144-145 MHz. The Experimenter Class would be authorized all above 29 MHz, and the Communicator Class all above 144 MHz. The Extra Class and Experimenter Class would be authorized all amateur emissions. The Advanced Class would be authorized all amateur emissions permitted below 29 MHz. The General and Technician Classes would be authorized emissions A1, A3, and F3. The Novice Class would continue with A1 only, while the new Communicator Class would be permitted emission F3. Related examination elements would contain questions concerning the technical and operational aspects of the emissions authorized.

15. In proposing maximum transmitter power levels, we have taken into consideration a number of factors. Amateur transmitters have not been a significant source of interference to other services, and where there has been a problem, amateurs have been very cooperative. Also, amateurs, by and large, do use the minimum transmitter power necessary to conduct their communications. Therefore, there should be no real problem if the limits were to be increased in some instances. We would like to improve the technique specified in the Rules for determining power. Modern communications requires better methods for determining transmitter power than the "plate voltage times current" method. We are proposing to specify the maximum transmitter output in terms of peak envelope power (PEP), except at the beginner level where the emissions authorized do permit a fairly accurate measurement to be made of the input power using the method now specified. Under current rules and practices, the maximum output peak envelope power that could be developed would be on the order of 2000 watts (100% modulated, full carrier, double sideband A3). Specifying this level as advanced amateur practice, and 6 dB (approximately one "S" unit) as intermediate amateur practice (500 watts PEP output) is the method used to establish these proposals. An additional 6 dB lower step (250 watts input approximates 125 watts output PEP for A1 and F3 emissions) would be the beginner level. 6/

1. Eligibility of currently licensed amateur radio operators for proposed new operator licenses, without further examination.

PROPOSED OPERATOR CLASSES / CURRENT OPERATOR CLASSES	Amateur Extra Class	Amateur Extra (C) Class	Advanced Class	Advanced (C) Class	General Class	Conditional Class	Conditional (P) Class	Technician Class	Technician (C) Class	Novice Class
Extra Class	X									
Extra (D) Class		X								
SERIES B										
Experimenter Class			X							
Experimenter (C) Class										
Experimenter (D) Class				X						
Technician Class					X			X		
Technician (C) Class						X			X	
Technician (D) Class							X			
Communicator Class										
SERIES A										
Advanced Class			X							
Advanced (C) Class										
Advanced (D) Class				X						
General Class					X					
General (C) Class						X				
General (D) Class							X			
Novice Class								X	X	X

16. The requirements for a new license, as shown in Appendix II, are similar to those now in effect, except the content of the various examination elements would be adjusted to more closely correlate with the privileges for each particular license class. While we are not proposing to lower, or increase, the telegraphy speed requirements, we are proposing a modification in the manner of testing. In RM-1724, the petitioner claims most operators must pass through a "code hump" between the speeds of 11 and 13 words per minute. Possibly the 5 wpm rate and the 10 wpm rate require the same skill level. In any event, the 13 wpm rate does require a skill level above that required for a 5 wpm rate. Otherwise, there would be no point to have both a Technician Class and a General Class under the present rules, since the two skill levels are the only difference between the requirements. Therefore, we are not proposing any changes in the telegraphy examination speeds.

17. Under the proposed system, the operator license for an amateur

6/ See 1/, Appendix II, p. 21.

qualifying by means of a mail examination on the basis of a protracted physical disability would have the letter (D) inserted following the operator class [example: Advanced (D) class]. A license of this type would be renewable without re-examination upon satisfactory showing the disability continued, and they could not appear for a regular Commission supervised examination. Otherwise, they would be required to demonstrate their proficiency through re-examination. The operator license of an amateur qualifying by means of a mail examination on the basis of difficulty in traveling to a regular Commission examination point, would have the letter (C) inserted following the operator class (example: General (C) class). The only purpose of this conditionally issued type of license would be to provide a temporary authorization until the person could qualify before a Commission examiner. Hence, these licenses would not be renewable, since it would not be unreasonable to expect a conditionally licensed amateur to travel to one of the many Commission examining points sometime within the five year period. He would then have to successfully complete a regular Commission supervised examination in order to continue as an amateur radio operator.

18. In the best interests of the Amateur Radio Service, and to be fair to all amateurs, we believe that every applicant should clearly establish his qualifications for the privileges authorized by an amateur radio operator license. Overall, our experience indicates mail examinations are not as effective as Commission supervised examinations in establishing qualifications. Because of our experience in re-examining amateur radio operators, and considering the proposed amendments may place additional demands upon a mail examination system, we are proposing some amendments in Appendix 2 intended to improve the system. Only an Extra Class licensee would be eligible to serve as a volunteer examiner for all examination elements. Advanced Class licensees would be eligible to administer examination elements for the General (C) and (D), and Novice Classes. Experimenter Class licensees would be eligible to administer examination elements for the Technician (C) and (D), and the Communicator Classes. Another proposal is to increase the required number of persons administering a volunteer examination. The second person may be the holder of any class of amateur operator license.

19. A specific call sign proposal is not included in this proceeding. However, because of the ramifications of this proposal, some relative comments are appropriate. *Existing licensees* will be able to retain current call signs if desired, and if authorized for both privileges, the same call sign may be used in both Series A and B. Licensees in Series B entering amateur radio as a result of this proceeding, will be issued a distinctive call sign for operation in that Series. If a later authorization for Series A privileges is granted, the single resulting call sign will reflect the dual Series authorization. Under this proposal, Technician Class licensees could obtain Novice privileges in Series A without examination, and therefore could retain their present call signs if desired. Further details will be contained in the call sign proceeding to be issued.

20. In view of the extensive amendments to the rules requested by the petitioners, and those proposed herein, it is imperative those submitting comments carefully consider the future needs of the Amateur Radio Service. To this end, we are allowing more than the normal amount of time for suggestions and comments to be filed. These proposals represent our best thoughts in these important matters. We are interested in receiving comments from informed amateurs in these areas.

21. Authority for the proposed rule changes herein is contained in §§4(i) and 303 of the Communications Act of 1934, as amended.

22. Pursuant to applicable procedures set forth in §1.415 of the Commission's Rules, interested persons may file comments on or before June 16, 1975, and reply comments on or before July 16, 1975. All relevant and timely comments and reply comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision on the rules which are proposed herein, the Commission may also take into account other relevant information before it, in addition to the specific comments invited by this Notice.

23. In accordance with the provision of §1.419 of the Commission's Rules and Regulations, an original and 14 copies of all comments, pleadings, briefs, or other documents shall be furnished the Commission.

24. All filings in this proceeding will be available for examination by interested parties during regular business hours in the Commission's public reference room at its headquarters in Washington, D.C., (1919 M Street, N.W.).

FEDERAL COMMUNICATIONS COMMISSION
Vincent J. Mullins
Secretary

APPENDIX I
Petitioners

1. RM-1016 D. McGarrett, Centerreach, New York
2. RM-1363 K. J. Deskur, Endwell, New York
3. RM-1454 S. C. Davis, Manchester, Connecticut
4. RM-1456 W. Green, Peterborough, New Hampshire
5. RM-1516 E. W. DeCloedt, Cupertino, California
6. RM-1521 W. A. Welch, II, Wappong, Connecticut
7. RM-1526 E. C. Lips, Pittsburgh, Pennsylvania
8. RM-1535 American Radio Relay League, Newington, Connecticut
9. RM-1568 E. E. Gooch, Brilliant, Ohio
10. RM-1572 C. DeWitt, Omaha, Nebraska
11. RM-1602 C. R. Clark, Notre Dame, Indiana
12. RM-1615 C. C. Drumeller, Warr Acres, Oklahoma
13. RM-1629 M. K. Gormley, APO, New York, New York
14. RM-1633 W. Green, Peterborough, New Hampshire
15. RM-1656 Ronald A. Reed, West Los Angeles, California
16. RM-1724 R. A. Cowan, Port Washington, New York
17. RM-1793 G. Jacobs, Silver Springs, Maryland, S.F. Meyer, Linden, New Jersey
18. RM-1805 Radiotrician Confederation, Grouse Creek, Utah
19. RM-1841 United CBers of America, Detroit, Michigan
20. RM-1920 C. W. Tazewll, Baltimore, Maryland
21. RM-1947 R. R. Dopmeyer, Opelousa, Louisiana
22. RM-1976 Edgewood Amateur Radio Society, Baldwin Park, California
23. RM-1991 U.S. Citizens Radio Council
24. RM-2030 L. E. White, Closter, New Jersey
25. RM-2043 R. E. Heimberger, Shaker Heights, Ohio
26. RM-2053 Hercules Radio and Recording Studio, Daytona Beach Florida

27. RM-2149 M. R. Wardean, Venice, California

28. RM-2150 W. A. Schroeder, Cherry Hill, New Jersey

29. RM-2162 Falmouth Amateur Radio Association, Woods Hole, Massachusetts

30. RM-2166 W. Brady, Norwalk, California

31. RM-2216 H. M. Krawetz, Sunnyvale, California

32. RM-2219 J. C. Hallford, Ft. Stockton, Texas

33. RM-2256 M. S. Donnell, San Jose, California

34. RM-2284 S. E. Green, et al, Austin, Texas

35. RM-2449 P. Williams, Santa Cruz, California

APPENDIX II

Part 97, of Chapter I of Title 47 of the Code of Federal Regulations is amended as follows:

1. §97.5 is amended to read:

§97.5 Classes of operator licenses.

(a) The following Series A operator licenses authorize operations in the amateur radio frequency bands below 29 MHz:

(1) Advanced Class, Advanced (C) Class, Advanced (D) Class. Licenses to conduct amateur radio communications using advanced level amateur practices.

(2) General Class, General (C) Class, General (D) Class. Intermediate grade licenses to conduct amateur radio communication for the purpose of developing individual proficiency toward qualifying for the Advanced Class license.

(3) Novice Class. Introductory grade license to conduct amateur radio operation for the purpose of developing proficiency toward qualifying for the General Class license.

(b) The following Series B operator licenses authorize operations in the amateur radio frequency bands above 29 MHz:

(1) Experimenter Class, Experimenter (C) Class, Experimenter (D) Class. Licenses to conduct amateur radio communication using advanced level practices.

(2) Technician Class, Technician (C) Class, Technician (D) Class. Intermediate grade licenses to conduct amateur radio communication for the purpose of developing individual proficiency toward qualifying for the Experimenter Class license.

(3) Communicator Class. Introductory grade license to conduct amateur radio communication for the purpose of developing individual proficiency toward qualifying for the Technician Class and Novice Class licenses.

(c) The Extra Class and Extra (D) Class licenses authorize amateur radio operation using all authorized privileges, including certain exclusive privileges.

(d) The designator (C) following the type of operator license class indicates the license is conditionally issued because the licensee qualified under the provisions of §97.28.

(e) The designator (D) following the type of operator license class indicates the license is conditionally issued because the licensee qualified under the provisions of §97.27.

2. §97.7 is amended to read as follows:

§97.7 Privileges of operator license.

The following operating privileges are authorized by the class of operator license indicated for all new amateur licenses issued after (effective date of new rules). Amateurs licensed prior to the date will receive a new license upon the first renewal after (effective date of new rules).

(a) Extra Classes. All amateur radio operator privileges.

(b) Advanced Classes. All amateur radio operator privileges below 29 MHz, except for frequencies 3500-3525 kHz, 7000-7025 kHz 14000-14025 kHz, and 21.000-21.025 MHz.

(c) General Classes.

(1) Frequencies 1800-2000 kHz, 3525-3775 kHz, 3890-4000 kHz, 7.025-7.150 MHz, 7.225-7.300 MHz, 14,025-14.200 kHz, 14.275-14.350 kHz, 21.025-21.250 MHz, 21.350. -21.450 MHz and 28.0-29.0 MHz within the limitations of §97.61.

(2) Emissions A1, A3, and F3.

(3) Except for power limitations set forth in §97.61, the maximum transmitter output power shall not exceed 500 watts peak envelope power.

(d) Novice Class.

(1) Frequencies 3700-3750 kHz, 7100-7150 kHz, (7050-7075 kHz when the amateur radio operation is not within Region 2), 21.100-21.200 MHz, and 28.100-28.200 MHz.

(2) Emission A1.

(3) 250 watts input power to the transmitter final amplifying stage supplying radio frequency energy to the antenna, exclusive of power for heating the cathode of a vacuum tube(s), within the limitations of §97.67.

(e) Experimenter Classes. All amateur radio operator privileges above 29 MHz.

(f) Technician Classes.

(1) All amateur frequencies above 50 MHz.

(2) Emissions A1, A3, and F3.

(3) Except for power limitations set forth in §97.61, the maximum transmitter output power shall not exceed 500 watts peak envelope power.

(g) Communicator Class.

(1) All amateur frequencies above 144 MHz.

(2) Emission F3.

(3) 250 watts input power to the transmitter final amplifying stage supplying radio frequency energy to the antenna, exclusive of power for heating the cathode of a vacuum tube(s), within the limitations of §97.67.

3. §97.9 is revised to read as follows:

§97.9 Eligibility for a new operator license.

Any citizen 1/ or national of the United States is eligible to apply for an amateur radio operator license. A person may be issued no more than one operator license in Series A, and no more than one in Series B. A holder of an Extra Class operator license may not hold any other amateur radio operator license issued by the Commission. The requirements for each operator class are:

(a) Extra Class: Applicant shall have successfully completed examination elements 1(C), 2(A), 2(B), 3(A), 3(B), 4(A), and 4(B).

(b) Advanced Class: Applicant shall have successfully completed examination elements 1(B), 2(A), 3(A), and 4(A).

(c) General Class: Applicant shall have successfully completed examination elements 1(B), 2(A), and 3(A).

(d) Novice Class: Applicant shall have successfully completed examination elements 1(A) and 2(A).

(e) Experimenter Class: Applicant shall have successfully completed examination elements 1(A), 2(B), 3(B), and 4(B).

(f) Technician Class: Applicant shall have successfully completed examination elements 1(A), 2(B), and 3(B).

(g) Communicator Class: Applicant shall have successfully completed examination element 2(B).

4. Section 97.13 and headnote are revised to read as follows:

§97.13 Eligibility for renewal of operator license.

(a) An amateur radio operator license, other than a conditionally issued license, may be renewed upon proper application, in which it is

1/ Senate Bill 2457 if enacted; would delete citizenship requirement.

stated that the applicant is fully qualified in the requirements for the original license of the class being renewed. If the applicant is not fully qualified, the license will not be renewed, and the applicant may apply for a new operator license if and when he qualifies by examination at a later date.

(b) If a license, other than a conditionally issued license, is allowed to expire, application for renewal may be made during a period of grace of 1 year after the expiration date. During this 1 year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of its expiration.

(c) Application for renewal of an amateur radio operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's operator license or photocopy thereof. Application for renewal of unexpired licenses must be made during the license term. In any case in which the licensee has, in accordance with the provisions of this section, made timely and sufficient application for renewal of an unexpired license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined.

(d) Operator licenses obtained on the basis of §97.28 are not renewable.

(e) Operator licenses obtained on the basis of §97.27 are not renewable unless the application is accompanied by a current physician's affidavit.

(f) Extra Class operator licenses are issued for the life of the licensee, and do not have to be renewed.

5. Section 97.15 is added new to read as follows:

§97.15 Modification of operator license.

(a) Application for modification of an amateur radio operator license shall be submitted on FCC Form 610 and shall be accompanied by the applicant's operator license(s) or photocopy(s) thereof.

(b) When only the name of the licensee is changed, or when only the mailing address is changed, a formal application for modification of license is not required. However, the licensee shall notify the Commission promptly of these changes. The notice, which may be in letter form, shall contain the name and address of the licensee as they appear in the Commission's records, the new name and/or address, as the case may be, the primary station call sign and class of operator license. The notice shall be sent to Federal Communications Commission, Gettysburg, Pennsylvania 17325, and a copy shall be kept by the licensee until a new license is issued.

6. Section 97.21 is revised to read as follows:

§97.21 Examination elements.

Examination for amateur radio operator privileges will comprise one or more of the following elements:

(a) Element 1(A): Slow speed telegraphy test in International Morse code at 5 words per minute.

(b) Element 1(B): Intermediate speed telegraphy test in International Morse code at 13 words per minute.

(c) Element 1(C): High speed telegraphy test in International Morse code at 20 words per minute.

(d) Element 2(A): Rules, basic principles, and amateur practices essential to beginners' amateur radiotelegraphy operation using the privileges authorized to the Novice Class.

(e) Element 2(B): Rules, basic principles, and amateur practices essential to beginners' amateur radiotelephony operation using the privileges authorized to the Communicator Class.

(f) Element 3(A): Rules, intermediate level principles, and amateur practices essential to amateur radio operation using the privileges authorized to the General Class.

(g) Element 3(B): Rules, intermediate level principles, and amateur practices essential to amateur radio operation using the privileges authorized to the Technician Classes.

(h) Element 4(A): Advanced level principles and amateur practices essential to amateur radio operation using the privileges authorized to the Advanced Class.

(i) Element 4(B): Advanced level principles and amateur practices essential to amateur radio operation using the privileges authorized to the Experimenter Class.

7. Section 97.23 is revised to read as follows:

97.23 Examination requirements.

(a) The telegraphy test required of an applicant for an amateur radio operator license shall determine the applicant's ability to send correctly by hand using a hand key (or, if supplied by the applicant, a semi-automatic or electronic, hand operated key, other than keyboard type) and to receive correctly by ear, in plain language, messages in the International Morse code at not less than the prescribed speed, counting 5 characters to the word, each numeral or each punctuation mark counting as 2 characters.

(b) All written examinations for an amateur radio operator license shall be completed by the applicant in legible handwriting or hand printing by means of ink or pencil. Whenever the applicant's signature is required, his normal signature shall be used. Applicants unable to comply with these requirements, because of a physical disability, may dictate their answers to the examination questions and to the receiving code test. If the examination, or any part thereof, is dictated by the applicant, the examiner shall certify the nature of the applicant's disability and the name and address of the person(s) taking and transcribing the dictation.

8. Section 97.25 is revised to read as follows:

§97.25 Examination credit.

(a) An applicant for an amateur radio operator license will be given credit for those examination elements required for any other class or operator license held when the application is filed. However, credit will not be given for examination elements 1(B), 3(A), 3(B), 4(A), and 4(B) given under the provisions of §97.30 for a class of operator license other than that being applied for, except for holders of Advanced (D) Class, Experimenter (D) Class, General (D) Class, and Technician (D) Class when qualifying for a license under the provisions of §97.27.

NOTE: Credit for examination elements will be given to applicants holding a valid operator license at the time of the adoption of this rule, in accord with the following schedule, during a period not exceeding one year following the expiration date on the current license:

(1) Amateur Extra Class: All examination elements.

(2) Amateur Extra (C) Class: Elements 1(A), 2(A) and 2(B). Also all other examination elements as if passed on the basis of §97.27.

(3) Advanced Class: Elements 1(A), 1(B), 2(A), 2(B), 3(A), 3(B), 4(A), and 4(B).

(4) Advanced (C) Class: Elements 1(A), 2(A), and 2(B). Also elements 1(B), 3(A), 3(B), 4(A), and 4(B) as if passed on the basis of §97.27.

(5) General Class: Elements 1(A), 1(B), 2(A), 2(B), 3(A), and 3(B).

(6) Conditional Class: Elements 1(A), 2(A), and 2(B). Also elements 1(B), 3(A), and 3(B) if passed on the basis of §97.28.

LETTERS

ANOTHER TROUBLEMAKER

Please take your magazine and shove it – into my new mailbox.

Sundry folk say you're biased, muck-raking, and print too much on subjects other than ham radio. So what? I get two ham mags, and yours is the one which gets read first and more thoroughly (even with the small type).

Maybe it's because I'm a gadfly myself in other areas, that keeps me behind you – just don't let me forget to renew, or you'll really get a nasty letter.

Jim Tolson WA9JTW

HE KEEPS UP

Personally, I find the satellite interesting – even after 42 years as a ham! For example, I have four uplink antennas and three downlink antennas, all on coax switches. Changing from one to the other is most educational, as you can imagine. Listening, with your own ears, to the results of your tests by monitoring your own downlink signal on 29 MHz, leaves no room for inflated reports, baloney reports, etc., etc. Very illuminating. I also, with a Variac, have changed transmitter output from 35 Watts to 1 Watt and observed what happened.

Stuart D. Cowan W2LX

MORE FAN MAIL

Would you like some fan mail? Here it is!! First I am not a Ham or Radio Amateur. I am just interested in general electronics and its many applications. Also since I work with Low Light Level TV on AC-130 gunships in Thailand, I am also interested in electronics as it applies to TV both transmitted and closed circuit. I like the idea of your proposed Solid State column. The only problem is I can't decide which columnist from the samples published would be the best, they are all good! As for your publishing your problems with the IRS, KEEP DOING IT!!! Maybe if more people spoke up the US Internal Police Service would be put back in the normal judicial system where it belongs.

Ralph A. Linder Jr.

RESPONSE TO "FAN MAIL"

Under the "Fan Mail" section, the letter from K6BR should be disregarded. Hillsborough, California is a town reserved for the VERY RICH. Obviously Mr. Naylor can be critical of you and your tax problems. He probably has never had to pay any. And he probably owns several shares of stock in the IRS.

Alan Christian WA6YOB

PROBLEM SOLVED

The Baltimore Amateur Radio Club maintains a machine on 07/67. Sometime this month the present 07/67 will switch to 34/94. This will be a calling repeater only, with 30 seconds time out. Once it times out it will take 30 seconds to reset, so it won't be much good for anything except a quick call. BARC is putting up a whole new repeater on 07/67 which will have a lot better coverage.

What they eventually want with the calling repeater is for everyone to monitor 94. Then you can make a call and switch to a rag chewing repeater. The way it is now is I have to call people on as many as 4 repeaters before I find the one they are monitoring. A calling repeater will solve this problem.

Steve Uhrig WA3SWS

EXPERIMENTERS NEEDED

Wanted: Serious, qualified, intelligent hams interested in vital fundamentals of life to read the "Fields of Life" by Dr. Harold S. Burr, Ballantine paperback 23559 $1.50 and/or "Design for Destiny" by Ed. W. Russell, Ballantine 23405 $1.25 and then develop suitable direct current amplifiers that are stable and can be duplicated with reliability and economy so that these Fields of Life can be measured in millivolts with extremely high input resistance. To be used with ordinary test meters such as 20k ohms per volt VOM. Special electrodes needed too.

Use in family planning and as an indicator of disease. It gets down to what really makes us tick and where we go from here. From Ballantine Books Inc., 201 E. 50th St., NYC 10022 plus two bits postage per order. Doctors and others here interested. All correspondence answered.

Charles A. Moore XE1CMB
Av. 27 Poniente 2520
Puebla, Puebla, Mexico

RF CLIPPER

That Clipper is built around the low cost filters from Amperex. I checked with the company. They are no longer in Houppauge and dropped the filter line. The Clipper is good but other sources of filters have to be found.

Kurt Bittmann WB2YVY

Can't win 'em all. . . Wayne

?

In reference to 73 Magazine, Sept. '74 page 27. I was reading the address of the author of "A Ham Radio Severe Weather Warning Net". Is the street number printed correct, or was the typist thinking about transistors while writing the draft.

. . . WA3RSP

While the typist MAY have been thinking about transistors at the time, she also had her mind on her work. Yes, the address is correct.

. . . Wayne

Continued on page 131

(7) Conditional Class (P) Class: Elements 1(A), 2(A), and 2(B). Also elements 1(B), 3(A), and 3(B) as if passed on the basis of § 97.27.

(8) Technician Class: Elements 1(A), 2(B), 3(A) and 3(B).

(9) Technician (C) Class: Elements 1(A), 2(A), and 2(B). Also elements 3(A) and 3(B) as if passed on the basis of § 97.28.

(10) Novice Class: Elements 1(A) and 2(A).

(b) Upon request, an applicant for an amateur radio license will be given credit for element 1(A) and 1(B) if within 5 years prior to the receipt of his application by the Commission, he held a commercial radiotelegraph operator license or permit issued by the Federal Communications Commission.

(c) Upon request, an applicant for an amateur radio operator license will be given credit for elements 1(A), 1(B), and 1(C), if he holds a valid First Class commercial radiotelegraph operator license or holds any commercial radiotelegraph operator license or permit issued by the Commission containing aircraft radiotelegraph endorsement.

(d) Applicant submitting evidence of having held the Amateur Extra First Class operator license and having held its successor license will be given credit for examination element 1(C) if he so requests. An applicant must present his proof in advance of the desired examination time to the Amateur and Citizens Division, Washington, D.C., 20554 and receive a letter of certification for presentation to the Commission Field Office where the examination will be taken. No credit for the telegraphy requirement will be given without the letter of certification.

9. Section 97.27 and headnote are revised to read as follows:

§ 97.27 Availability of operator license to physically disabled persons.

If it is shown by physician's certificate an applicant is unable to travel to any regular Commission examination point because of a protracted physical disability, a new or renewed Extra (D) Class, Advanced (D) Class, Experimenter (D) Class, General (D) Class, or Technician (D) Class operator license may be issued on the basis of examinations successfully passed under the provisions of § 97.30. These licenses may not be renewed without a current physician's affidavit.

10. Section 97.28 and headnote are revised to read as follows:

§ 97.28 Availability of operator license to persons residing at great distances from Commission examination points.

(a) A new Advanced (C) Class, Experimenter (C) Class, General (C) Class, or Technician (C) Class license may be issued on the basis of examinations successfully passed under the provisions of § 97.30 under one of the following conditions:

(1) If the applicant's legal residence, mailing address, and/or any station location or proposed station location are more than 175 miles actual distance from the nearest Commission examining point.

(2) If the applicant is shown by certificate of the commanding officer to be in the armed forces of the United States at an Army, Navy, Air Force, or Coast Guard station and, for that reason, to be unable to appear for examination at a Commission examination point.

(3) If the applicant demonstrates by sufficient evidence that he is unable to appear at a Commission examination point because his current temporary residence, for the 12 coming months is outside the continental limits of the United States, its territories or possessions.

(b) Operator licenses obtained under the provisions of these rules are not renewable.

11. Section 97.29 and headnote are revised to read as follows:

§ 97.29 Manner of conducting Commission supervised examinations.

(a) Except as provided by § 97.27 and § 97.28, examination elements 1(B), 1(C), 3(A), 3(B), 4(A) and 4(B) may only be administered by an authorized Commission employee or representative at locations and at times specified by the Commission.

(b) Examination element 4(A) may only be administered to a person having successfully passed element 3(C).

(C) Examination element 4(B) may only be administered to a person having successfully passed element 3(B).

(d) Examination element 3(A) may only be administered to a person having successfully passed element 2(A).

(e) Examination element 3(B) may only be administered to a person having successfully passed examination elements 2(B).

12. Section 97.30 is added new to read as follows:

§ 97.30 Manner of conducting mail examinations.

(a) Unless otherwise prescribed by the Commission, examination elements 1(A), 2(A), 2(B), and any elements administered under the provisions of § 97.27 and § 97.28 will be conducted and supervised by two proxy volunteer examiners proposed by the applicant and approved by the Commission. The volunteer examiners shall be at least 21 years of age, shall be unrelated to the applicant, and at least one shall hold the proper class of license to administer examinations in accordance with the following schedule:

(1) Extra Class: All examination elements.

(2) Advanced Class: Examination elements 1(A), 1(B), 2(A), and 3(A).

(3) Experimenter Class: Examination elements 1(A), 2(B), and 3(B).

(b) Written examinations shall be obtained, administered, and submitted in accordance with the following procedure:

(1) Within 10 days after successfully passing any required telegraphy examination element, an applicant shall submit an application (FCC Form 610), together with any filing fee prescribed, to the Commission's office in Gettysburg, Pennsylvania 17325. The application shall include a written request from the volunteer examiners for the appropriate examination papers. The examiners' written request shall include (1) the name and mailing address of the volunteer examiners, (2) the name of the applicant, (3) a statement by the volunteer examiners that the applicant has passed the telegraphy examination element for the class of operator license, if required, under their supervision within the 10 days prior to the submission of the request, and (4) the volunteer examiners' signatures. Examination papers will be forwarded to one of the volunteer examiners.

NOTE: When the applicant is entitled to credit for any telegraphy examination element under the provisions of § 97.25, an application may be submitted without regard to the 10 day limitation. The examiners' request should then state that a telegraphy examination was not administered for that reason. The applicant should furnish details as to the class, number, and expiration date of any license involved.

(2) The proxy volunteer examiners shall be responsible for the proper conduct and necessary supervisions of the examination. Administration of the examination shall be in accordance with the instructions included

with the examination papers.

(3) The examination papers, either completed, or unopened in the event the examination if not administered for whatever reason, shall be returned by the volunteer examiner to the Commission's office at Gettysburg, Pennsylvania, no later than 30 days after the date the papers are mailed by the Commission (the date of mailing is normally stamped by the Commission on the outside of the examination envelope).

13. Section 97.33 is amended to read as follows:

§97.33 Eligibility for re-examination.

An applicant who fails an examination for an amateur radio operator license may not take another examination for the same or higher class license in the same series within 30 days.

14. Section 97.35 and headnote are revised to read as follows:

§97.35 Additional requirements for licensees holding licenses on the basis of mail examinations.

(a) A licensee holding an amateur radio operator license obtained by a mail examination administered by proxy volunteer examiners may be required to appear for a Commission supervised examination at a location designated by the Commission. If the licensee fails to appear for this examination when directed to do so, or fails to pass such examination, the amateur radio license(s) involved shall be subject to cancellation. When a license is cancelled under this provision, a new license will not be issued for the same class of operator license as that cancelled.

(b) A holder of an amateur radio operator license obtained on the basis of a mail examination under the provisions of §97.27 shall make application for re-examination within one-year upon becoming able to travel to any Commission examination point.

(c) A holder of an amateur radio operator license obtained on the basis of mail examination under the provisions of §97.28 shall apply for re-examination within one-year of when the licensee changes his legal residence, or mailing address, and/or any station or proposed station location within 175 miles actual distance to the nearest Commission examination point, or when a new examination point is established within 175 actual miles distance to the licensee's legal residence, mailing address, or station location.

15. Section 97.38 is added new to read as follows:

§97.38 Types of station licenses and eligibility.

(a) The following types of station licenses are available to properly licensed amateur radio operators.

Type of station	Eligible licensees
Series A Primary station.	Extra Class, any Series A Class operator.
Series A Secondary station.	—do—
Series B Primary station.	Extra Class, any Series B Class operator.
Series B Secondary station.	—do—
Series A Club station.	Extra Class, Advanced Class operator.
Series B Club station.	Extra Class, Experimenter Class operator.
Repeater station, Control station, Auxiliary Link station, Space station.	Extra Class, Experimenter Class operator.
Military Recreation station.	Individual, whether or not a licensed amateur radio operator, who is in charge of a proposed Military Recreation station.

16. Section 97.67(a) & (b) are amended and part (d) added to read as follows:

§97.67. Maximum authorized power.

(a) Within all other limitations specified herein, amateur radio stations shall use the minimum amount of transmitter power necessary to carry out the desired communications.

(b) Except for power limitations set forth in §97.7 and §97.61, the maximum transmitter output power shall not exceed 2000 watts peak envelope power.1/

(d) Any transmitter capable of exceeding the power limitations specified herein shall not be operated in the Amateur Radio Service unless there is incorporated adequate measures to insure the limitations will not be exceeded.

1/ This is one proposal under consideration. The Commission is also considering alternatives such as PEP-input, average power input, ratios of peak to average power output and limitations on dissipation ratings of final power amplifier devices or a combination of these. Specific comments on the practicality of these proposals, alternate proposals and the practicality of attendant power measuring techniques by amateur stations are requested.

We request comments on the need for rules limiting the use of techniques which increase the average power in A3 single sideband suppressed carrier transmissions, without increasing the peak envelope power. The comments should discuss the various techniques utilized for the purpose in the Amateur Radio Service, the engineering standards that must be observed for good amateur practice when using these techniques, the nature of any unnecessary interference that can be caused by the improper use of these techniques, and the capabilities of amateurs to make measurements necessary to proper usage.

E.H. Sommerfield W2FJT
49 Spring Road
Poughkeepsie NY 12601

Sneaky Fast Scan Monitor for SSTV

When operating SSTV the use of a fast scan monitor provides the means to adjust the scene at a 15 frames/second rate rather than the standard 8 seconds/frame rate – a ratio in round numbers of 120:1. Commercial fast scan display units sell for about $250. Oscilloscopes now sell in the $120 range and are usually large and bulky. Who wants to tie up a scope for display only? This article describes modifications that can be made to a standard Heathkit monitor scope, found in many stations, to provide the fast scan display feature for the popular Robot 80A Camera.

The modification is based upon the assumption that the trapezoidal display found in the HO-10 is seldom used. I have used it only once in 5 years.

Circuit Descriptions

Vertical Amplifier

The vertical amplifier, Fig. 1, was modified to satisfy two criteria:

1. Maximum sensitivity to a positive sawtooth at V1A.
2. No voltage transients on external vertical input line when mode switch is operated from display to EXT.

The vertical fast scan signal, from the 80A camera, is taken directly from the vertical yoke. This is a positive going sawtooth with a negative magnetic overshoot. C7 is used to minimize that overshoot. Notice that the coupling capacitor C3 is located on the input

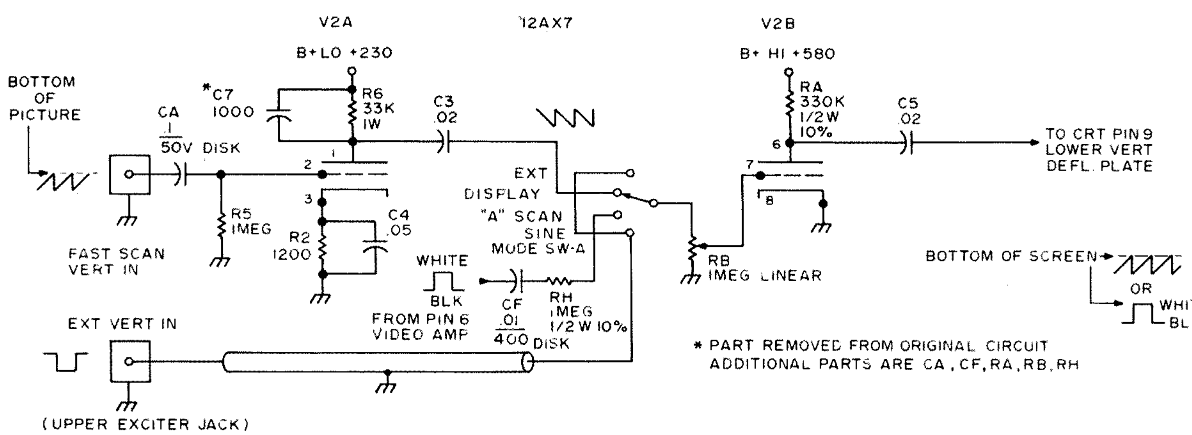


Fig. 1.

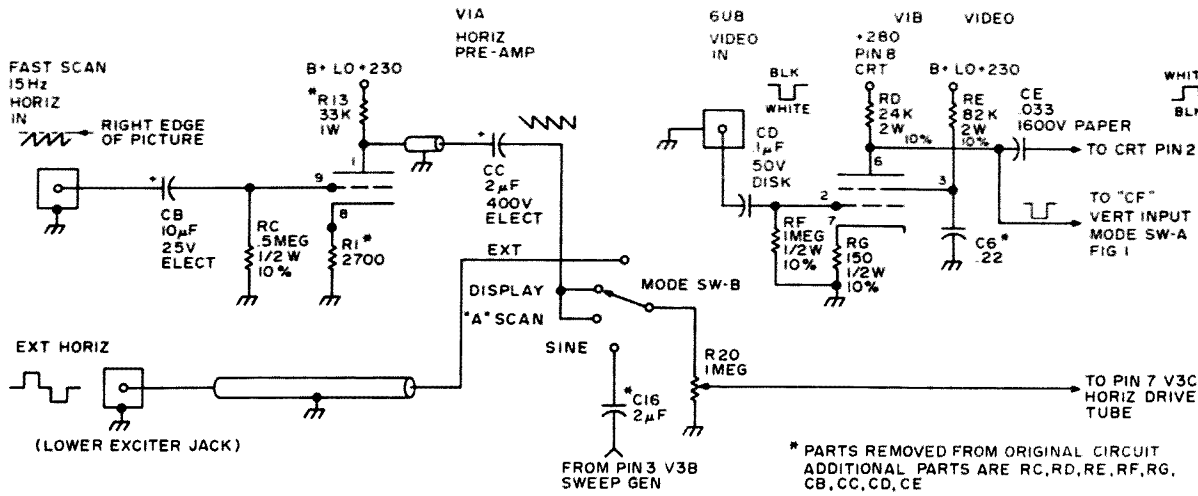


Fig. 2.

side of mode switch-A to prevent voltage transients from being applied to the external vertical input line when the mode switch is operated. Such voltage transients could damage external semiconductor circuits.

Horizontal Amplifier

The horizontal fast scan signal from the 80A camera is a positive going sawtooth. The amplitude of this signal is about the same as the fast scan vertical signal and requires two stages of amplification, Fig. 2. V1A the horizontal preamplifier must pass a 15Hz signal which accounts for the large capacitances (CB,CC). Notice also that both coupling capacitances have been moved to the input side of mode switch-B. This was done, as in the case of the vertical amplifier, to prevent voltage transients from being applied to the external horizontal input line when the mode switch is operated.

Video Amplifier

The HO-12 has no provision for video, or Z input. A video amplifier, Fig. 2, described by ROBOT in their Field Service note #4 was installed in V2B. This circuit is sensitive to negative pulsing signals. The video grid resistor, RF, or the bias resistor, RG, can be made variable for gain control. I found 150Ω for RG satisfactory using the intensity control to vary the display. If the display is

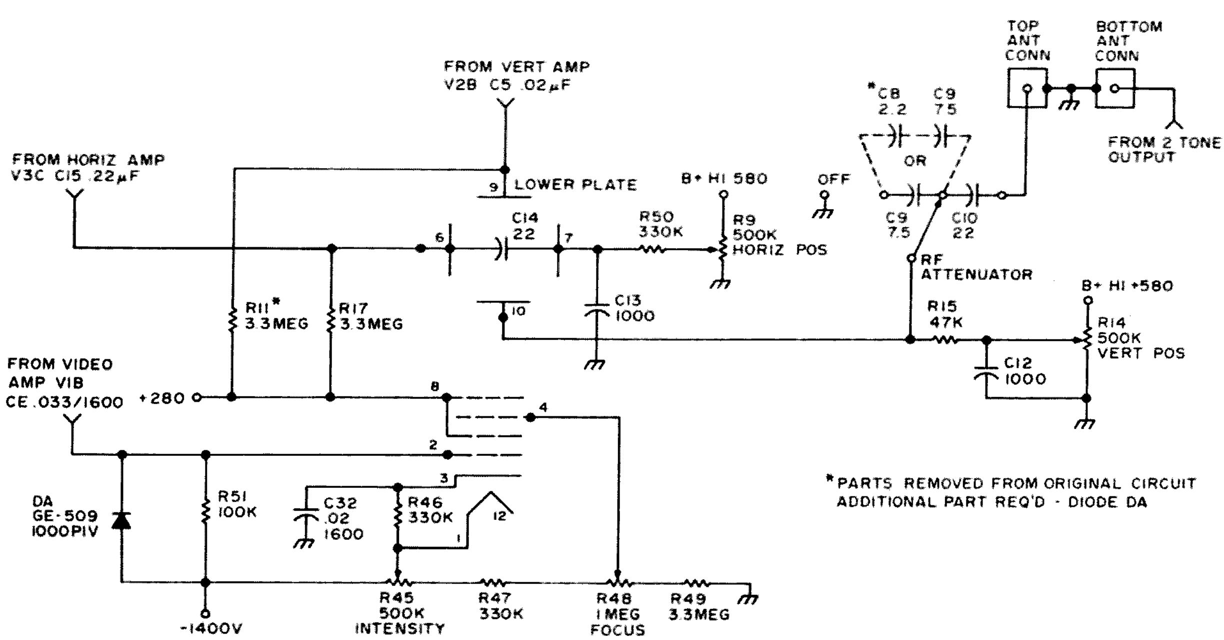


Fig. 3.

too contrasty RG can be increased to 240-300Ω as required.

CRT

Three basic modifications were made to the CRT, Fig. 3, circuitry to:

1. Increase the vertical deflection.
2. Provide Z or video input.
3. Provide means to shut off the rf signal vertical input.

The 1MΩ resistor connected to the vertical deflection plate pin 9 was increased to 3.3μM. C8, through which the lowest level rf signal is applied to the vertical deflection plate, was removed and the switch point grounded to provide a means to shut off the rf input. This allows the display to be viewed while the picture is being transmitted – good if you're prone to move. In most cases it is not necessary to view the rf unless setting up or in case of troubles.

Mode Switch/"A" Scan Feature

The mode switch was changed from a 2-pole 3-position to a 2-pole 4-position switch, see Figs. 1 and 2. The currently installed mode switch has 2-poles 5-positions with only 3 being used, and can be modified with some difficulty. I recommend a new 2-pole 4-position switch.

The extra position allows amplified fast scan video to be applied to the vertical input and fast scan deflection to the horizontal input. These two signals result in an "A" scan, allowing synchronized video to be displayed. An "A" scan display is used for precise adjustment of the camera brightness control (see operation).

Physical Modification

In order to keep the fast scan signals together, the video input was entered via the two tone jack. The two tone signal was relocated to the lower antenna connector. Since there was no room to mount a terminal strip near the two tone tube, V4, the junction of R30, R38 and R52 was soldered to a short length of stiff wire the other end of which connects to the lower antenna connector. The junction is, therefore, self-supporting. In order to prevent the junction from shorting to pot R29 a strip of plastic tape was placed on the pot. The antenna is connected to the single connector via a coax "T" fitting.

The two exciter connectors, now no longer needed, were used for the external inputs; the top for vertical and the bottom for horizontal. The location of these connectors is convenient for connecting shielded wires to the mode switch.

The .003μF. 1600V video coupling capacitor CE and the 24K 2W RD are connected via a 3 lug terminal strip. This strip is mounted on the side of CRT neck that is closest to the bottom side of the chassis. It is mounted using the same screw that mounts a terminal strip already in this

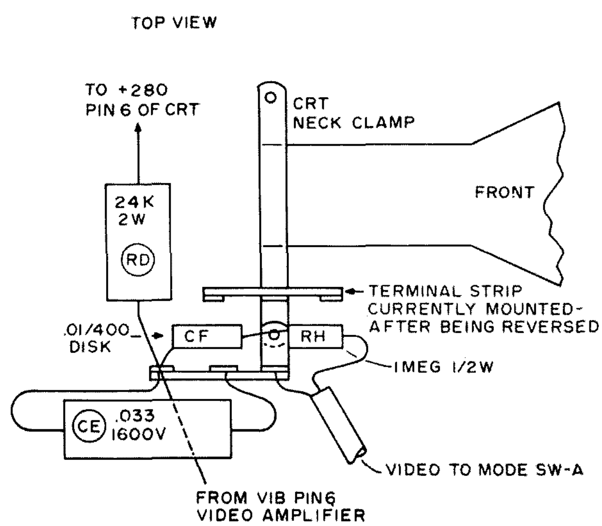


Fig. 4.

location, Fig. 4. The strip currently mounted must be positioned such that its body is towards the CRT neck.

Coupling capacitors 2μF 600V CD, and .02μF C3 are mounted in the area of the mode switch.

The .22μF C6 is relocated from pin 8 to pin 3 of V1. Do not remove the ground end.

Don't physically remove the wire connecting pin 7 of V1 to pin 7 of the CRT. This wire is later used from pin 6 of V1B to the .033/1600 CE located on the CRT neck.

The shielded lead from V1 pin 2 is relocated to V1 pin 1.

External Inputs

Two external inputs, vertical and horizontal, were wired to the mode switch to

Operation

		Mode Switch		
HO-10	**Sine**	**A-Scan**	**Display**	**Ext.**
Intensity	Adjust to level to eliminate "Z" modulation	Normal	Black looks black	As desired
Focus		As required for intensity.		
Vertical gain and Position		As required but below ovarload level.		
Horizontal and Position		As required.		
Sweep Frequency	As required	N/A	N/A	N/A
Rf Attenuator (in rear)	As required	Off	Off/On When on, SSB rf overlays display during transmission, but can still be seen.	Off

permit attachment of an audio frequency spectrum analyzer or other device. The sensitivity of the vertical input is too negative pulsing. The sensitivity of the horizontal input is either polarity. Note that both external inputs are direct, not ac coupled. This was done in order to keep these inputs flexible. This allows the coupling capacitors to be matched to the external signal source frequencies and voltage polarities.

Power Supply Considerations Under No-Signal Input Conditions

The 6BN8 required 600mA of filament current. The 12AT7/12AX7 requires only 300mA, a net reduction of 1.9W.

The original V2B required 7.2mA at 580V, the revised V2B requires about 1.5mA at 580V – a net savings of 3.3W.

The new horizontal preamp requires 3.3mA at 230V or an additional .76W.

The new video amplifier requires 4.9mA at 230V or an additional 1.2W.

The net high voltage current drain is plus 1.5mA.

These values will vary of course, under signal conditions. But the net change is towards less power consumption.

Chart

In order to adjust camera brightness, set mode switch to "A" scan. Black will be towards the top of the screen and white will be towards the bottom of the screen. Adjust camera brightness for maximum difference between black and white signals levels. Notice that any further increase in brightness causes an increase in the overall down position of the vertical spikes (background shading), but does not increase the white to black ratio of the picture elements. This can be checked by switching to the display mode and "rocking" the brightness control either side of the optimum setting. The contrast can now be adjusted by looking at both display and "A" scan positions of the mode switch and touching up the brightness as required.

Conclusion

The display obtained with these modifications completely fills the screen and then some. The linearity of the display is not of TV quality but is more than sufficient for this application.

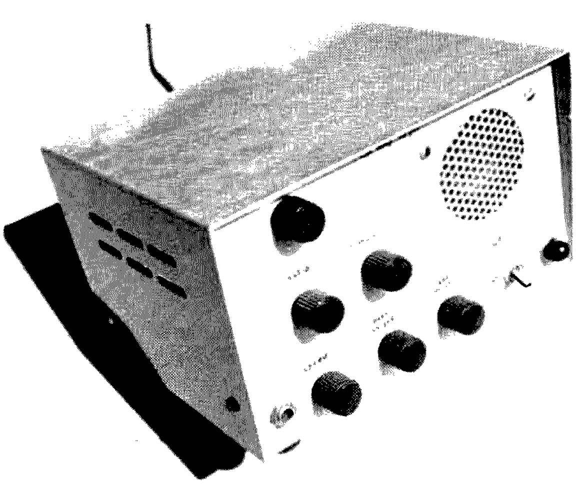
The camera was operational for one week before the modifications to the HO-10 were completed. The difference in performance and picture quality and the ease which they are obtained, has definitely established the need for Fast Scan Display. The estimated cost of $11 for new parts is, without a doubt, a good investment to increase the versatility of an already valuable piece of monitoring equipment. . . .W2FJT

Richard Winkelman K6ZN
Henry Olson W6GXN
P.O. Box 995
Menlo Park CA 94025

Behold! — Super-key

Most electronic keyers either do not offer a variable dot-to-dash ratio, or if they do, than the dot-to-dash ratio usually changes with speed or weight. Timing is normally done by a multivibrator, which inherently causes the dot-to-dash ratio to vary with speed or weight. To solve this problem, a keyer was constructed which uses an integrator as the timing element. This circuit offers the following features:

1. A single potentiometer adjusts the speed continuously over a 3 to 1 range, and a switch changes ranges. Changing the speed has no effect on the ratio of dots to dashes or the weight (on-to-off time) of a character.
2. A single potentiometer adjusts the ratio of dots to dashes by changing the speed of the dots but not the dashes. This adjustment does not affect the weight.
3. The weight is controlled by two separate potentiometers, one for dots and one for dashes. These adjustments are not interacting and do not affect the speed or ratio.



4. Characters are self-completing. When a dot or dash is started, it is automatically completed and a space inserted between it and the next character.
5. Dot insertion is used. This permits dots to be inserted between a train of dashes, without releasing the dash key.

Fig. 1, shows the circuit which forms a dot or dash. An operational amplifier is used as an integrator. An operational amplifier is simply a very high gain amplifier. As far as the external circuit is concerned, the operational amplifier can be considered to have infinite gain, infinite input impedance, and a low output impedance. In Fig. 1, the two inputs to the operational amplifier are labeled (-) and (+). When a capacitor is connected between the output and the inverting input (-), it becomes an integrator. It is called an integrator, because all of the current, i_1, must flow into the capacitor, C, and the output voltage V_O adjusts itself so that the capacitor voltage is equal to the integral of the current, i_1, divided by C. In other words, the capacitor voltage, V_O, equals:

$$\int \frac{i_1\, dt}{c} = \frac{\bar{i}_1\, \Delta t}{c}$$

where i_1 is the average current over a time interval, Δt. If S1A is closed and S1B is open, then $i_1 = +V_1/R_A$ flows into C, and the output voltage, V_O, falls linearly from V2 to V3, as shown in the graph, Fig. 2. If at time t_1, S1A is opened and S1B is closed, then $i_1 = -V1/R_B$ flows into C. V_O then starts rising from V3 toward V2. When V_O

reaches V2, if S1A and S1B are reversed again, the cycle repeats. V_O is fed to a flip flop which changes state each time V_O reaches V2 or V3, as shown in the graph in Fig. 2. The flip flop powers the switch S1. The flip flop also forms the dashes and dots. When the flip flop is in the ON state a dash (or dot) is being made, and when in the OFF state the spacing between dashes (or dots) is formed. In the practical circuit two R_1s are used and are switched in and out electronically. The smaller R_1 is used for dots and the larger R_1 for dashes. As the setting of the potentiometer arm changes, R_A and R_B change in such a manner that their sum is always equal to R1. It can be demonstrated that even though t1 changes as the potentiometer is varied, t2 does not change. In other words, the ON time plus the OFF time of a character is constant. Thus, variation in the weight has no effect upon the speed. Because there are two R1s, one for dashes and one for dots, the weight of dashes and dots are independently variable, and neither has any effect upon the speed. The ratio of dots to dashes is controlled by changing the value of V1 as the dot and dash potentiometers are switched in and out. That is, a different value of V1 is applied to the dash potentiometer than is applied to the dot potentiometer. The ratio of dots to dashes changes, because the speed of a character is directly proportional to V1.

Fig. 4, shows the logic block diagram, Fig. 5, the circuit diagram of the keyer, and Fig. 6, the circuit diagram of the power supply and sidetone oscillator.

In the ensuing discussion, the logic gates shown in Fig. 4, are called NOR gates and work in the following manner. A schematic diagram of the Motorola MC724P quad 2-input gates is shown in Fig. 3. Each package contains four separate two input gates. Let us illustrate with gate U3 (pins 12, 13, and 14), in the lower left hand corner of Fig. 4. Zero or low voltage is called logic "0" level. Positive or high voltage is called logic "1" level. If inputs 12 and 13 are both at zero voltage or "0" level, then the output on pin 14 is at "1" level. At a "1" level output, both of the gate transistors are open circuited, and the output terminal is driven by a 640Ω resistor to +3.6V. If either input 12 or 13, or both, are at logic "1," then one or the other gate transistor, or both, are saturated, and the output terminal is at logic "0," because the transistors effectively act as a short circuit to ground.

In the logic block diagram Fig 4, when the dash key is closed, the output of gate U3 at pin 14 rises to the "1" logic level. This assumes that pin 12, U3, is at the "0" level, which it will be if the dot control flip flop is in the quiescent state. When pin 14 (U3), rises, pin 14 (U1), drops to the "0" level. In the quiescent state, the "recharge" flip flop places a "1" level at pin 3 (U7), and pin 9 (U7), and a "0" level at pin 8 (U7), and pin 7 (U4). Therefore, pins 6 and 7 (U4), are both at "0," which causes a "1" at pin 5 (U4), which triggers the dash formation flip flop to the ON state. Pin 5 (U1), is changed from "0" to "1," which does several things. This causes pin 8 (U4), to move to the zero state, which means that the dash key can be released, and the dash control flip flop will still remain in the ON state. All of the foregoing happens in about a microsecond, which means that a slight touch of the dash key is all that is necessary to start a dash.

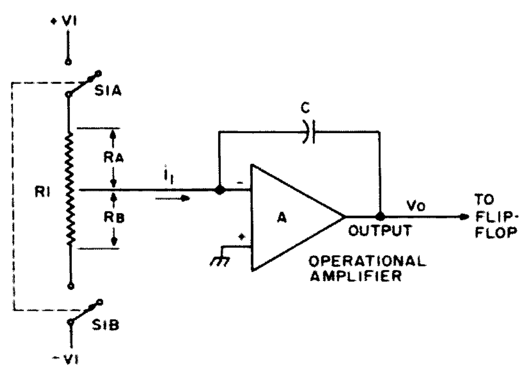


Fig. 1. Simple character formation circuit.

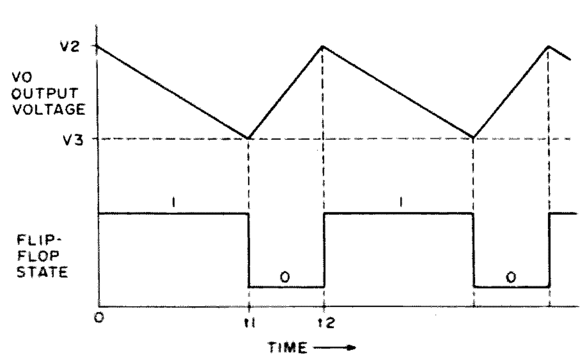


Fig. 2. Timing diagram of operational amplifier circuit of Fig. 1.

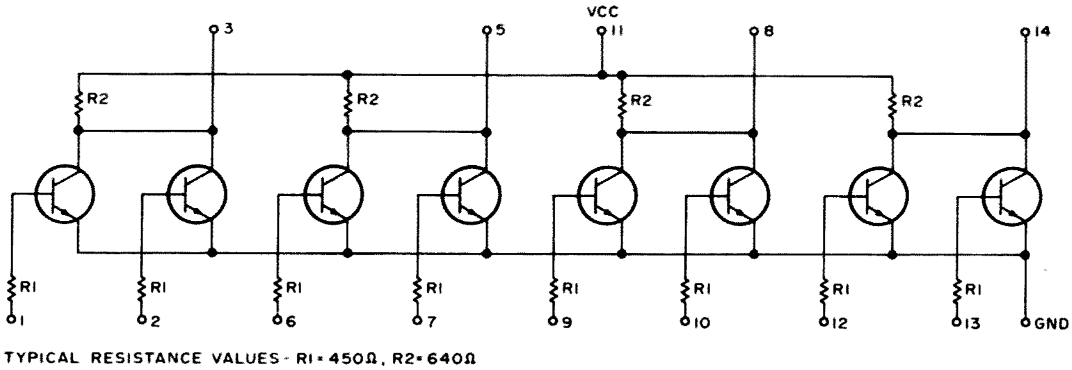


Fig. 3. Motorola MC 724P quad 2-input gate.

When pin 5 (U1), goes to "1," this turns off the recharge current source by causing pin 14 (U4), to drop to "0." The dash charge current source is turned on, which causes a constant charging current to be fed to the operational amplifier, U8. When pin 5 (U1), goes to "1," the base of Q5 goes to +1.3V, and about 1/3 milliampere of current flows through Q5 to Q4, which turns on and saturates Q4.

When Q4 is saturated, the voltage from emitter to collector is nearly 0V, which means that the voltage at the emitter of Q3 is applied directly to the top of R17. The voltage at the center arm of R33 is connected to the (-) input of the operational amplifier, U8. The trimpot, R50, is adjusted so that the (-) input remains within a millivolt of ground potential. A current flows from the emitter of Q3, through Q4, R17, and R33, into C4, C5, or C6 (whichever is connected). The magnitude of this current is equal to $V_a/(R_{17}+R_a)$, where V_a is the voltage at the base of Q3, and R_a is the resistance from the top of R33 to the center arm. As discussed earlier, the operational amplifier integrator causes the integrating capacitor to charge at a linear rate. The quiescent value of the voltage on the integrating capacitor is +9V. It is clamped at this level by the voltage divider action of R20, R36, and Q11. When the charging current flows into the integrating capacitor, the voltage starts falling linearly from +9 toward -9V. When it reaches -9V, the voltage divider action of R29 and R30 turns off

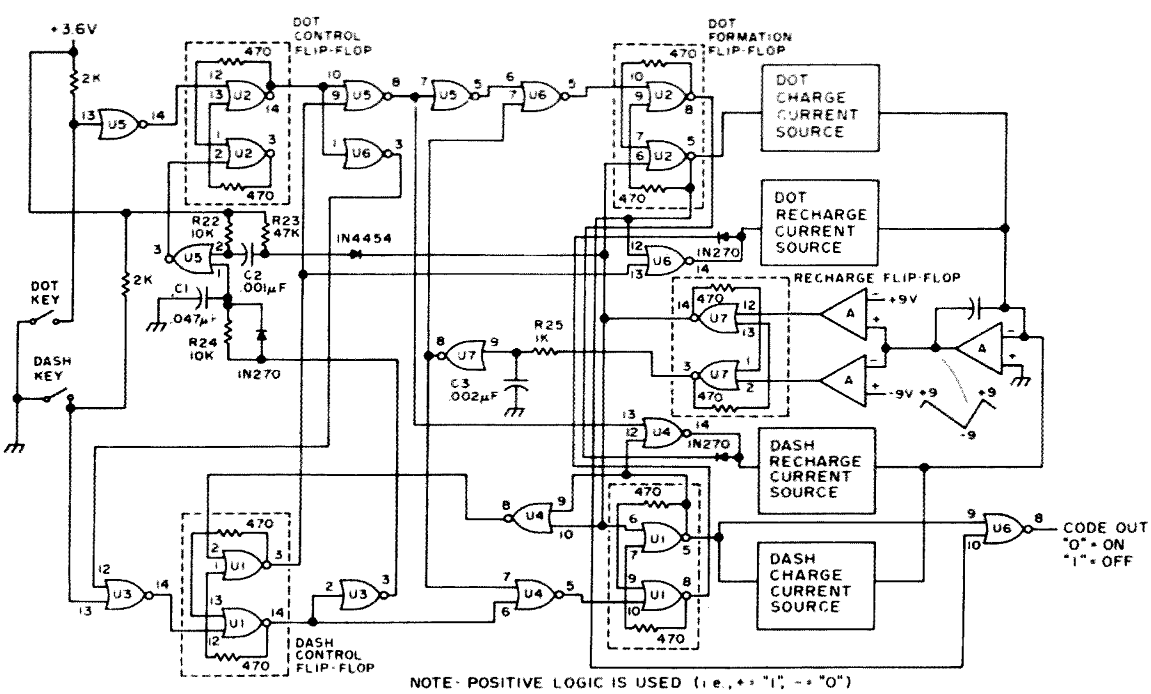
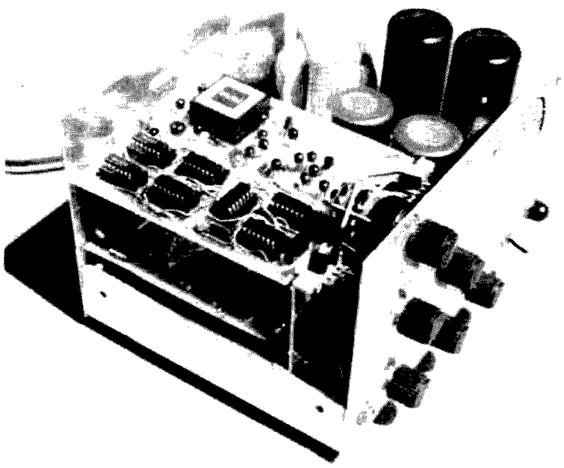


Fig. 4. Logic block diagram.

Q12, which applies a positive voltage to pin 2 (U7), which sets the "recharge" flip flop to the ON state. In the ON state pin 14 (U7) goes to "1" level, which resets the dash formation flip flop to the OFF state. This turns off the dash charging current and turns on the dash recharging current. When pin 5 (U1), goes to "0," pin 14 (U4), rises to "1." This assumes pin 13 (U4), is at "0," which it must be, because pin 9 (U5), is at the "1" level. When pin 14 (U4), rises to "1," about 1/3 milliampere of current flows through Q16 into Q18, which saturates Q18. The voltage drop from Q18 collector to emitter drops to nearly zero, and a current flows out of the integrating capacitor equal to $V_b(R_{35}+R_b)$, where V_b is the voltage at the emitter of Q19, and R_b is the resistance from the bottom of R33 to the center arm. This reverse current causes the integrating capacitor voltage to recharge from -9V back toward +9V. When +9V is reached, Q11 is again turned on, which clamps the voltage to +9. Q11 also turns on Q10, which applies a positive voltage to pin 12 (U7), which resets the recharge flip flop to the OFF state. Pin 14 (U7), goes to "0," which causes U4 (pin 8), to supply a "1" pulse to the dash control flip flop, resetting it to the OFF state. C3 and R25 insert a 2 micro-second time delay in the output of U7, this is so that the dash control flip flop can be reset to the OFF state, before pin 8 (U7), can fall to the 0 level. Otherwise, gate U4 (pin 5), could retrigger the dash formation flip flop, starting a new dash cycle. The dash cycle is now complete and everything is again in the quiescent state, awaiting initiation of a new character by the dash or dot key. If the dash key had not been released but had been kept continuously depressed, a new dash would have been started as soon as the recharge flip flop returned to the OFF state.

The formation of dots is similar to the formation of dashes. When the dot key is closed, pin 14 (U5), goes to "1," which sets the dot control flip flop to the ON state. Pin 10 (U5), goes to "0," and if pin 9 (U5), is at "0," which it would be if the dash control flip flop were in the OFF state, pin 8 (U5), goes to "1," pin 5 (U5), goes to "0" and U6 (pin 5), goes to "1," setting the dot formation flip flop to the ON state. This turns off



the dot recharge current, and turns on the dot charge current by turning on Q9, which saturates Q8. Q6 and Q7 are emitter voltage followers, so that the voltage at the center arm of R14 is applied to the top of R16, which causes a charging current to flow through the center arm of R34 into the integrating capacitor. The action of the integrator is exactly the same as for dashes, except that the integration is faster, because of higher charging current. The charging current is equal to $V_C/(R_{16}+R_C)$, where R_C is the resistance from the top of R_{34} to the center arm, and V_C is the voltage at the center arm of R14. Varying V_C by adjusting R14 changes the dot speed, which is directly proportional to the voltage V_C. It can be shown that with the center arm of R14 set at the top, the ratio of dash cycle time to dot cycle time is 3.1 to 1. By varying the setting of R14, this ratio can be lowered to as little as 1.7 to 1. When the integrator has charged from +9 to -9, the recharge flip flop is set to the ON state, which resets the dot formation flip flop to the OFF state. This turns off the charging current and turns on the recharge current by turning on Q13, which saturates Q14. The integrator recharges from -9 to +9, at which time the recharge flip flop is reset to the OFF state. The negative going reset pulse from pin 14 (U7), is differentiated by the network R23, C2, and R22, and passes through the gate U5 to reset the dot control flip flop to the OFF state. The differentiation network permits only the negative going leading edge of the pulse to do the resetting. The other input to

the U5 gate comes through the U3 gate from the dash control flip flop. When the dash control flip flop is on, U3 (pin 3), supplies a "1" level to pin 1 (U5), through the 1N270 diode. The "1" level prevents the dot control flip flop from being retriggered * until about 1/2ms after the dash control flip flop has returned to the OFF state. This permits the use of what is called "dot storage" or "dot insertion." During a train of dashes if the dot key is pressed, even for an instant, the dot control flip flop is set to the ON state. This places a "0" at pin 14 (U2), and a "1" level at U6 (pin 3), and U3 (pin 12). Gate U3 is then closed, causing the dash control flip flop to be reset to OFF at the end of the dash cycle. At that instant the dot control flip flop assumes control, and a dot is started. When the dot is completed, another dot will be started, if the dot key is still depressed. If not, the dot control flip flop is reset to OFF, which opens gate U3 and the dash control flip flop is again triggered, providing the dash key is still depressed. It can thus be seen how one dot or a string of dots can be inserted between two dashes without releasing the dash key. This is called "squeeze" or "dot insertion" keying, which some operators prefer. Of course, one does not have to use this "squeeze" feature.

***While the dash control flip-flop is in the on state, R24 and C1 prevent retriggering.**

The potentiometer R37 varies the speed. It does this by varying the voltage at the emitters of Q3 and Q19 in such a manner that these voltages are always equal but opposite in polarity. The voltage is divided down further by R14, to vary the dot speed relative to the dashes. R14 adjusts the ratio of dots to dashes. This ratio is not affected by the speed control, R37.

When a dash is being formed, pin 13 (U6), is at a "1" level, which produces a "0" level at pin 14 (U6), stopping the recharge current. Otherwise, it would interfere with the timing of the dash. Likewise U4 (pins 13 and 14) stops the dash recharge current while a dot is being formed. The diodes CR21 and CR22 serve no purpose except to prevent the dot and dash formation flip flops from latching up.

Code output is produced at U6 (pin 8), by combining the outputs of the dash and dot formation flip flops. Transistors Q1 and Q2 amplify the level, producing a 0 to +14V output pulse.

Fig. 6, shows the schematic diagram of the power supply and sidetone keyer. The power supply uses a Stancor transformer

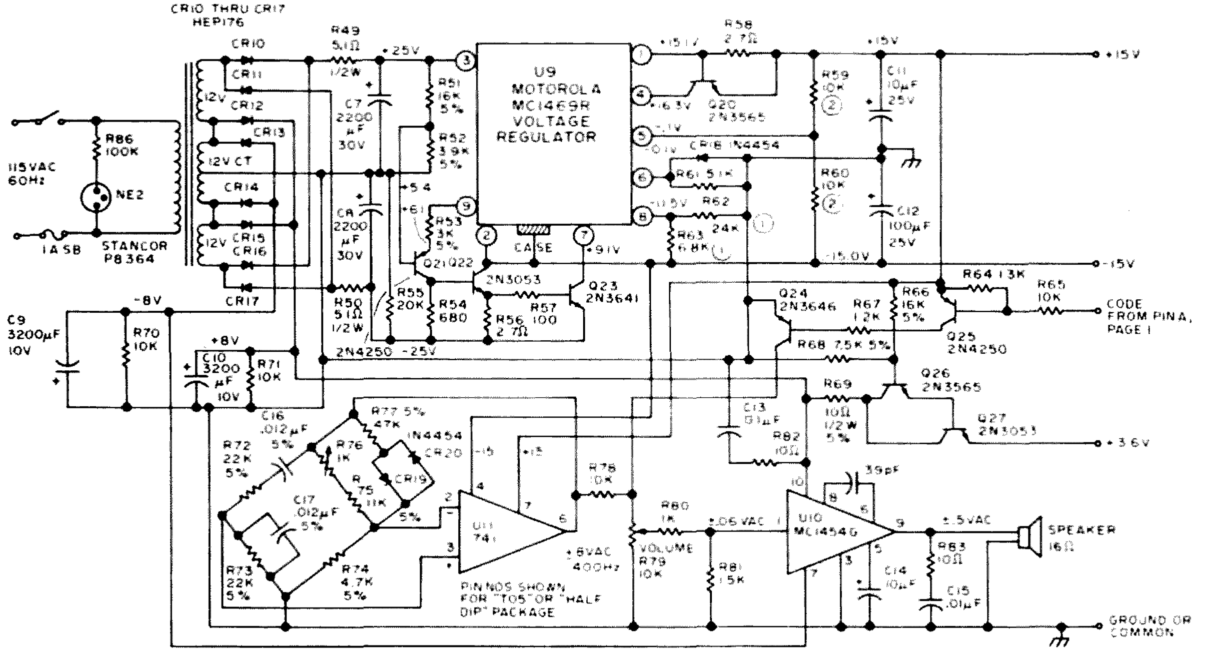
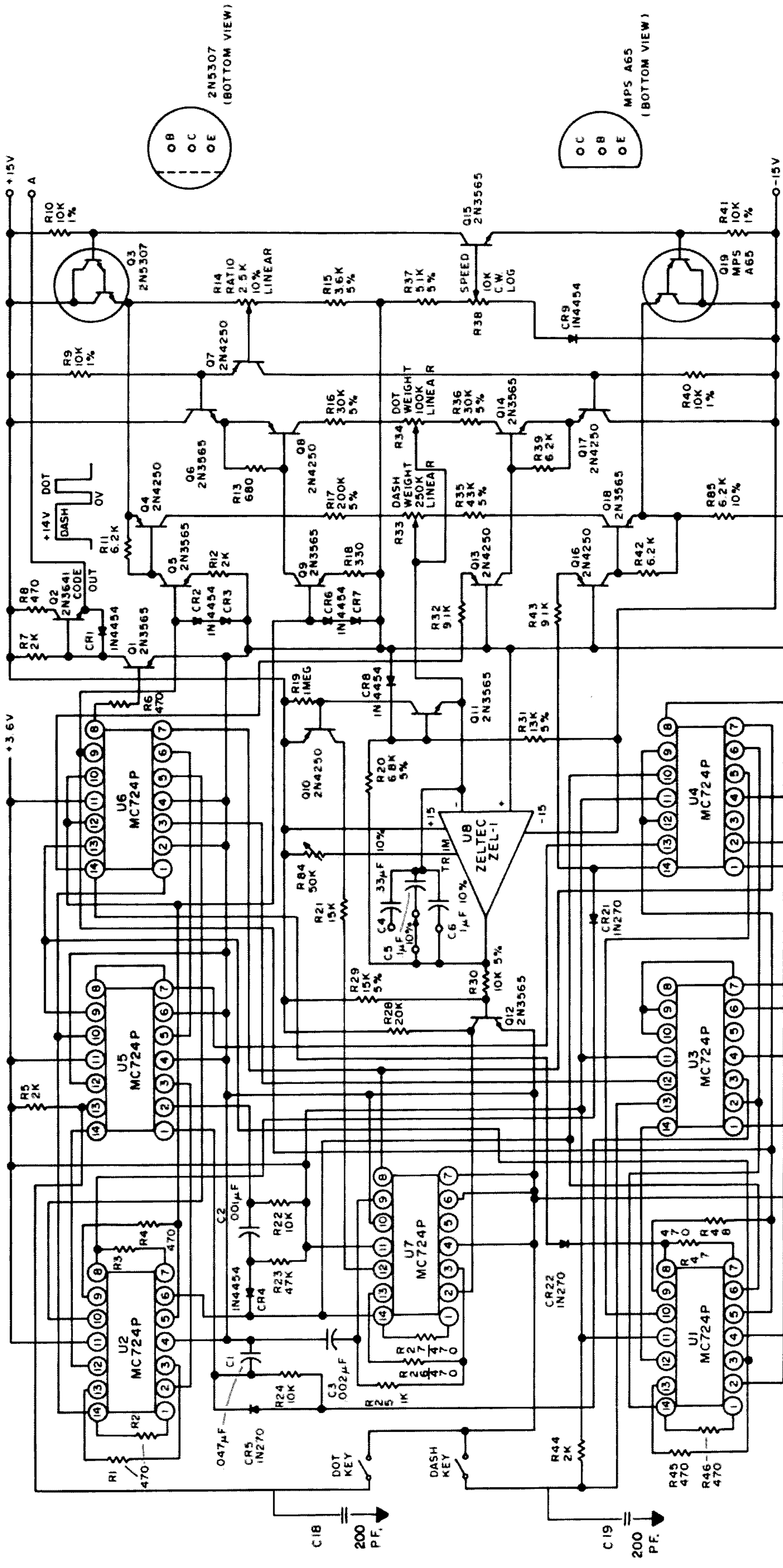


Fig. 6. Schematic of power supply and sidetone oscillator. Notes: 1. Select values of R62 and R63 which give exactly -15.00 V out. 2. Match R59 and R60 to 1% or select values which give +15.00 V out. 3. Resistors are in Ohms, ¼ Watt, 20% tolerance, and capacitors are in microfarads, 20% tolerance, unless otherwise indicated.



NOTES
1. VALUES ARE IN UNITS OF OHMS FOR RESISTORS & MICROFARADS FOR CAPACITORS, UNLESS OTHERWISE SHOWN.
TOLERANCE IS 20%, UNLESS OTHERWISE SHOWN.

Fig. 5. Schematic of keyer.

with the three secondary windings connected in series. Capacitors C7 and C8 charge to the peak ac voltage, about ±25V above and below ground. The voltage regulator circuit uses a Motorola MC1469R regulator. The circuit was taken from the Motorola Microelectronics Handbook, Second Edition. Load current is about 42mA at +15V dc and 13mA at -15V dc. As described in the notes, R62 and R63 are first selected to provide -15V dc output, and then R59 and R60 are matched to produce +15V dc output. Additional rectifiers produce -8V across C9, and +8 across C10, unregulated. The ±8V powers the audio amplifier, U10. The +8V is dropped by regulator transistors Q26 and Q27, which give +3.6V for the logic.

A Wien bridge is used as a 400Hz sinewave sidetone oscillator. U11 is a type 741 operational amplifier with input from a conventional Wien bridge circuit. CR19 and CR20 limit the oscillation amplitude. R76 is a variable resistor, which should be adjusted for ±8V peak oscillation amplitude at the output of U11. If difficulty is experienced in getting a ±8V oscillation amplitude, R75 might have to be varied slightly, possibly as much as 1 or 2K either way. The output of the oscillator is fed to a keyer circuit. Keying is accomplished by Q24, which acts as an open or short circuit to ground. Output from the volume control, R79, is fed through R80 to the power amplifier, U10, which drives a 16Ω speaker. Approximate normal listening levels are ±0.5V peak ac on the speaker with ±0.06V peak ac at pin 1, U10.

The code speed potentiometer produces about a 3.1 to 1 range of code speeds. This gives about 8 to 25 words per minute with the 0.2 microfarad integrating capacitor. The other two integrating capacitors change a factor of two, so that the total speed range is about 4 to 50 words per minute.

Construction

The keyer is housed in a cabinet made by L.M. Bender (L.M.B.), type W1C. Two etched circuit boards are used to provide the circuitry shown in Fig. 5 and 6. The boards accommodate all the smaller components – that is, all except the power transformer, large filter capacitors, panel switches, speaker, and panel controls. The two boards both are made to fit standard 22 pin card connectors, and are mounted one above the other to save cabinet space. The top-most card, Fig. 7, represents the circuitry shown in Fig. 5, and is the more complex. The bottom card, Fig. 8, is considerably simpler and represents the circuitry of Fig. 6.

The top card has all the digital ICs mounted on it plus the ZEL-1 hybrid IC op amp (U8). The digital ICs (U1 through U7) may be directly soldered into the board, or (as the authors prefer) 14 pin sockets may be used. The ZEL-1 (U8) was soldered into the board directly because the only socket available for this excellent op amp is huge and clumsy. There are a fairly large number of wire jumpers (insulated wire) on this board, because it is rather complex and only a single-sided board was used. However, the time to install the wire jumpers is small compared to the much more tedious task of laying out and etching a double-sided board. All but two of the transistors used on the top board are epoxy types made by Fairchild (and National Semiconductor). The two exceptions are also plastic-encapsulated types, but they are Darlington pairs: the 2N5307 (NPN Darlington) by G.E. and the MPS-A65 (PNP Darlington) by Motorola. All these transistors are soldered directly into the board.

The bottom card, on which is the circuitry of Fig. 6, has three ICs and eight transistors on it. Like the other card, the transistors are soldered directly into the board. However, in addition to six more of the inexpensive epoxy transistors, two metal can T05 types are used where greater dissipation is required in the voltage regulator section (2N3053's). U11 may be any of three different styles of the 741 type op amp, as manufactured by nearly every producer of linear ICs. The DIP (14 pins) and the "Half DIP" (8 pins) style of 741 will fit the board with or without the appropriate IC socket. The "T05" version of the 741 can be soldered in directly by spreading the leads slightly. U10 is soldered directly into the board, and has a heat dissipator clipped onto its T05 can. U9 is also directly soldered into the board, but mounted on .64cm (¼") metal spacers above the board. This way of

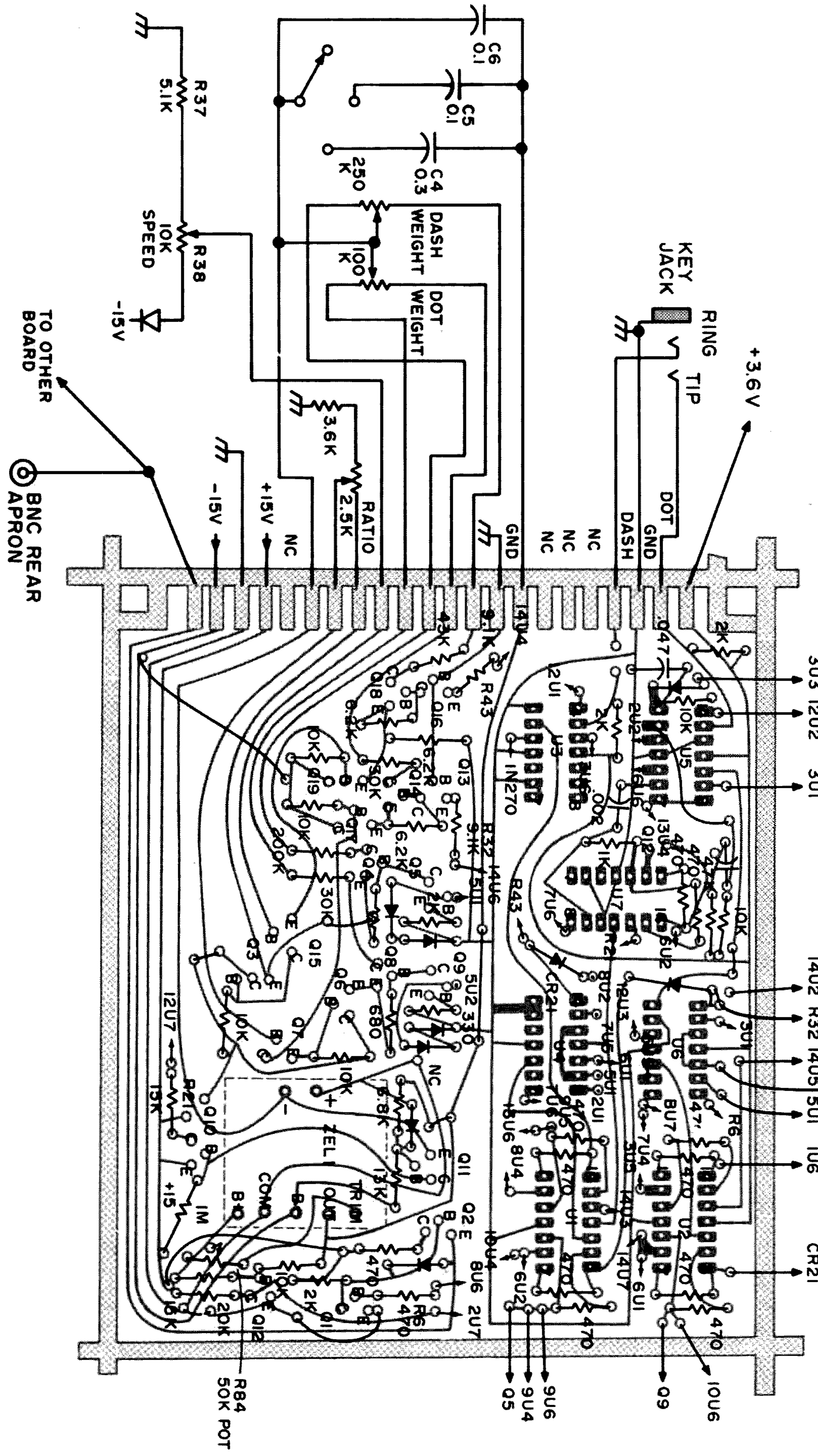


Fig. 7. Board layout of circuitry for Fig. 5.

assembly, HEP176.

CR18	1N4454	General Electric
CR19	"	"
CR20	"	"
CR21	1N270	Hughes
CR22	1N270	Hughes
U1	MC724P or HEP570	Motorola
U2	"	"
U3	"	"
U4	"	"
U5	"	"
U6	"	"
U7	"	"
U8	ZEL-1	Zeltec
U9	MC1469 or HEP-C6049R	"
U10	MC1454G or HEP593	"

U11 μA741 Circuit board will accept any D.I.P. or TO5 style as manufactured by Fairchild, National, Motorola, Signetics, etc. (μA741C, LM741C, MC1741C/HEP-C6052P, N5741, respectively).

Resistors are 20% tolerance, ¼ watt, values in ohms, except where otherwise noted.

R1	470 ohms.
R2	470 ohms
R3	470 ohms
R4	470
R5	2k
R6	470
R7	2k
R8	470
R9	10k, 1% tolerance
R10	10k, 1% tolerance
R11	6.2k
R12	2k
R13	680
R14	2.5k potentiometer, linear taper, 10% tolerance.
R15	3.6k, 5%
R16	30k, 5%
R17	200k, 5%
R18	330
R19	1 Megohm
R20	6.8 k, 5%
R21	15k
R22	10k
R23	47k
R24	10k
R25	1k
R26	470
R27	470
R28	20k
R29	15k, 5%
R30	10k, 5%
R31	13k, 5%
R32	9.1k
R33	250k potentiometer, linear taper, 10%.
R34	100k potentiometer, linear taper, 10%.
R35	43k, 5%
R36	30k, 5%
R37	5.1k, 5%
R38	10k, potentiometer, clockwise logarithmic taper, 10%.

mounting U9 allows the IC leads to flex and thus better register with the board layout pads. It is quite important that the case connect electrically with the pad on the board nearest the card edge (via a metal machine screw, spacer, and nut), since the case of the IC is one of its terminals.

As can be seen in the photographs, the "plug" ends of the circuit boards are toward the front panel where they mate with the two 22 pin card plugs. This puts the various inputs and outputs of the two boards immediately adjacent to the front panel controls to which they connect. The rest of the construction is conventional, and anyone building the keyer will probably add his own variations in the exact layout.

... K6ZN & W6GXN

Parts List

Q1	2N3565	Fairchild or National
Q2	2N3641	Fairchild or National
Q3	2N5307	General Electric
Q4	2N4250	Fairchild or National
Q5	2N3565	Fairchild or National
Q6	2N3565	"
Q7	2N4250	"
Q8	2N4250	"
Q9	2N3565	"
Q10	2N4250	"
Q11	2N3565	"
Q12	2N3565	"
Q13	2N4250	"
Q14	2N3565	"
Q15	2N3565	"
Q16	2N4250	"
Q17	2N4250	"
Q18	2N3565	" "
Q19	MPS A65	Motorola
Q20	2N3565	Fairchild or National
Q21	2N4250	"
Q22	2N3053	R.C.A.
Q23	2N3641	Fairchild or National
Q24	2N3646	"
Q25	2N4250	"
Q26	2N3565	"
Q27	2N3053	R.C.A.
CR1	1N4454	General Electric
CR2	"	"
CR3	"	"
CR4	"	"
CR5	1N270	Hughes
CR6	1N4454	General Electric
CR7	"	"
CR8	"	"
CR9	"	"
CR10 thru CR17		Motorola integrated circuit

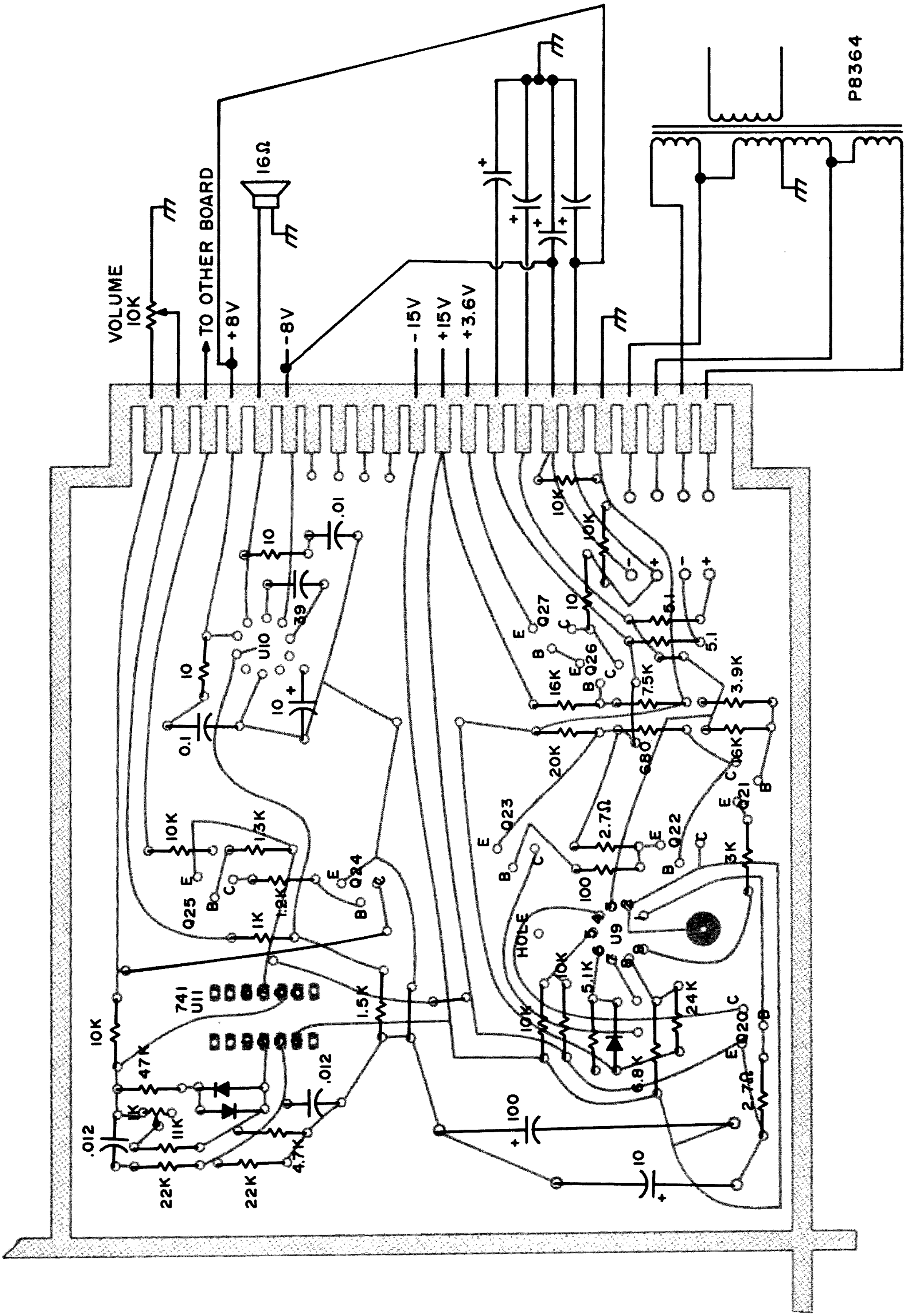


Fig. 8. Board layout of circuitry for Fig. 6.

R39 6.2k
R40 R41 10k, 1%
R42 6.2k
R43 9.1k
R44 2k
R45 thru R48 470 ohms
R49 & R50, 5.1 ohms, ½ watt
R51 15k, 5%
R52 3.9k 5%
R53 3k, 5%
R54 680
R55 20k
R56 2.7 ohms
R57 100 ohms
R58 2.7 ohms
R59 & R60, 10k, matched to 1%
R61 5.1k
R62 24k
R63 6.8k
R64 1.3k
R65 10k
R66 16k, 5%
R67 1.2k
R68 7.5k, 5%
R69 10 ohms, ½ watt, 5%
R70 10k
R71 10k
R72 & R73 22k, 5%
R74 4.7k, 5%
R75 11k, 5%
R76 1k, screw driver adjustable.
R77 47k, 5%
R78 10k
R79 10k potentiometer, logarithmic clockwise
R80 1k
R81 1.5 ohms
R82 & R83, 10 ohms
R84 50k trimpot
R85 6.2k 10%
R86 100k, 20%
Cabinet Bud LMB-W1C.
Transo
Transformer Stancor P8364
Capacitors are 20% tolerance, value in microfarads, unless otherwise noted.
C1 0.047 microfarad
C2 0.001 "
C3 0.002 "
C4 0.33 microfarad, Mylar, 10%
C5 0.1 microfarad, Mylar, 10%
C6 0.1 microfarad, Mylar, 10%
C7, C8, 2200 microfarads, 40 volts Mallory CGS222U040BB1.
C9, C10, 3200 microfarads, 10 volts, Mallory CG322U1OA1 or HC1040A.
C11 10 microfarads, 25 volts.
C12 100 microfarads, 25 volts.
C13 0.1 microfarads.
C14 10 microfarads, 10 volts
C15 0.01 microfarads
C16 0.012 microfarads, 5%
C17 0.012 microfarads, 5%
C18 200 picofarad, 20%
C19 200 picofarad, 20%

Ralph E. Taggart WB8DQT
4515 Oakwood Drive
Okemos MI 48864

What Time is the Next Satellite?

An Electronic Timer for Satellite Tracking

For anyone engaged in satellite tracking, either with the OSCAR communications satellites or the numerous weather satellites presently in orbit, there is a constant need for data on the position of the satellite in its orbit. The usual practice for both OSCAR and weather satellites is to receive the W1AW bulletins and utilize the data to calculate acquisition times. Logging the daily bulletins can become somewhat of a chore if time is limited and the calculations required for either short or long term acquisition data are also time consuming, even with a calculator. Two authors in a recent issue of QST (McKim and Simpson) presented ingenious mechanical timing systems for display of OSCAR orbital data. Both of these systems require a fair amount of mechanical work and reprograming. Either for a new satellite requires a fair amount of effort in selection of the proper gear ratios and possible mechanical alterations. In the course of my own experiments in reception of NOAA weather satellite imagery, I developed a series of digital timing arrays to permit unattended reception and tracking of the weather satellites I was interested in. The heart of the system that finally evolved was an all electronic timing unit that provides a visual display of equatorial crossing data, indicating the elapsed time since the last equatorial crossing. Since many of the tracking techniques adopted by amateurs utilize such data (Direct Transmission System, Users Guide, etc.) the unit would be very useful for stations engaged in OSCAR communications experiments. The unit will run for a month or more without requiring

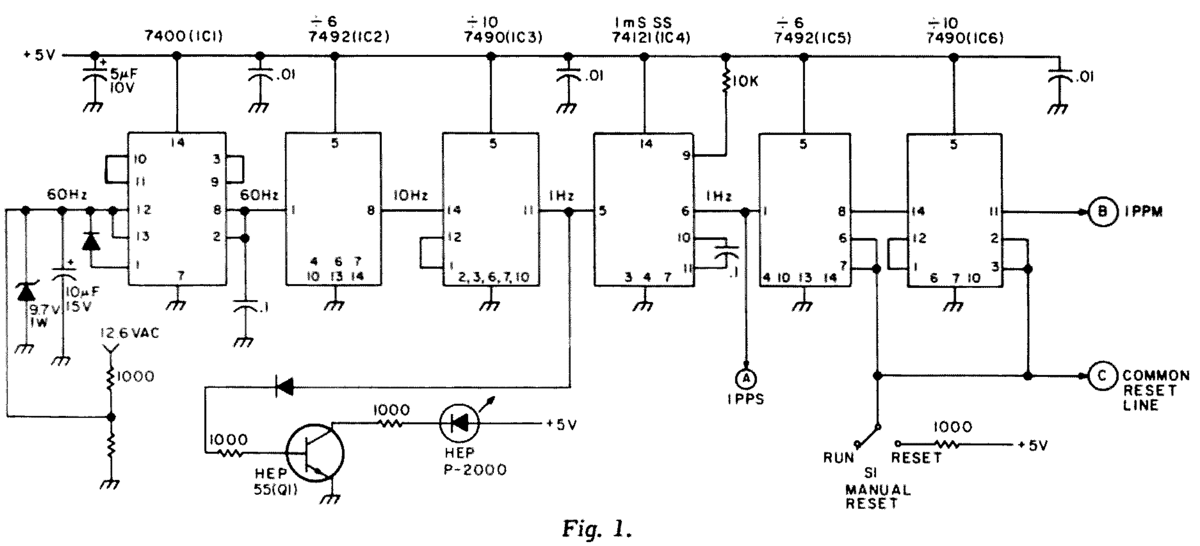
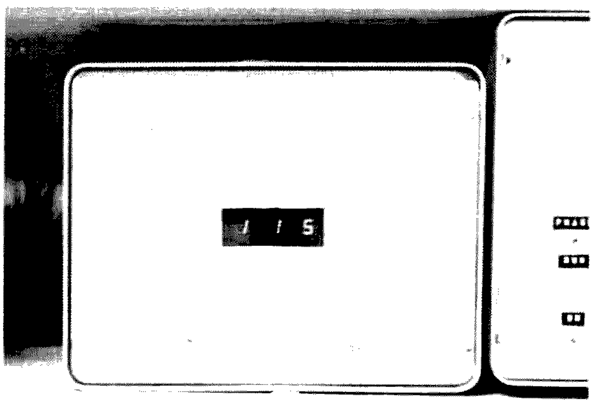


Fig. 1.

correction and reprograming for a new satellite orbital period requires less than five minutes and involves little more than changing four solder connections within the unit.

The satellite timing unit is nothing more than a glorified digital clock. Normal digital clocks count seconds, minutes and hours and rest the count to zero at the end of a 12 or 24 hour period. The satellite timer is essentially a clock that counts in seconds and resets at the end of each orbital period of the satellite. If the clock is started at any satellite equatorial crossing the unit begins



The author's satellite timer. The front window display indicates minutes since the last equatorial crossing. Since the timer is presently programed for a period of 116 minutes, 11 seconds, the 115 minutes displayed indicates that the satellite will shortly complete an orbit. The use of a red plastic filter behind the display windows allows the numbers to be viewed while blocking out details of the LEDs and circuit board. The toggle switch on the lower left is used to reset the timer two or three times a month to minimize accumulated errors. The switch on the lower right is a simple on/off power control.

displaying accumulated time and resets on the next crossing. The front panel display indicates the time in minutes since the previous crossing and can be used as the time base for tracking the satellite for any pass within range of the ground station.

Circuit Function

The timer unit has three principal subassemblies: A time base derived from the 60 Hz ac line to provide accurate 1 second and 1 minute pulses, an orbital timer board that provides an accurate reset of the display at the end of each orbital period, and a display board that provides the timing display on the front panel. TTL logic is used throughout and although a fairly large number of devices are used, they are available at very reasonable cost from a large number of surplus outlets.

The time base board, Fig. 1, consists of six integrated circuits. IC1 is a quad 2 input NAND gate which shapes the 60 Hz ac from the power supply transformer to provide 60 Hz square waves for the counters. IC2 and IC3 comprise a divide by 60 chain that provides square wave output pulses at a one pulse/second rate. These square waves drive a transistor (Q1) which switches a LED on and off at the one second rate. This LED doubles as a pilot lamp and also indicates the proper function of the early sections of the time base circuit. The output of IC3 is also routed to IC4, a single shot multivibrator which provides short pulses (1 ms) at the one second rate for the orbital timer board. IC3 is followed by IC5 and 6 which divide the 1 Hz square wave by 60 to develop a one pulse/minute square wave that drives the display board. The reset line of these two ICs is connected to a common reset bus for the entire unit. The reset bus is activated automatically by the orbital timer and resets the visual display. A manual reset switch (S1) is also provided on the reset line to start the timer at an equatorial crossing.

The orbital timer board, Fig. 2, counts seconds and resets all of the circuits when the proper total is reached for the satellite in question. The timer uses four decade counters (IC7-10) which can accumulate a total count of up to 9,999 seconds (slightly over 166 minutes), more than sufficient for any conceivable orbital configuration of OSCAR or weather satellites. Each of the ICs, storing counts of units, tens, hundreds, or thousands of seconds, is connected to a 7441 IC which functions as a binary coded decimal (BCD) to decimal decoder. Such decoders develop a low on the appropriate decimal output when a given BCD count appears in the decade counter. The reset function of the counter is based on detecting the presence of the desired total count at the decimal outputs of the 7441s and generating

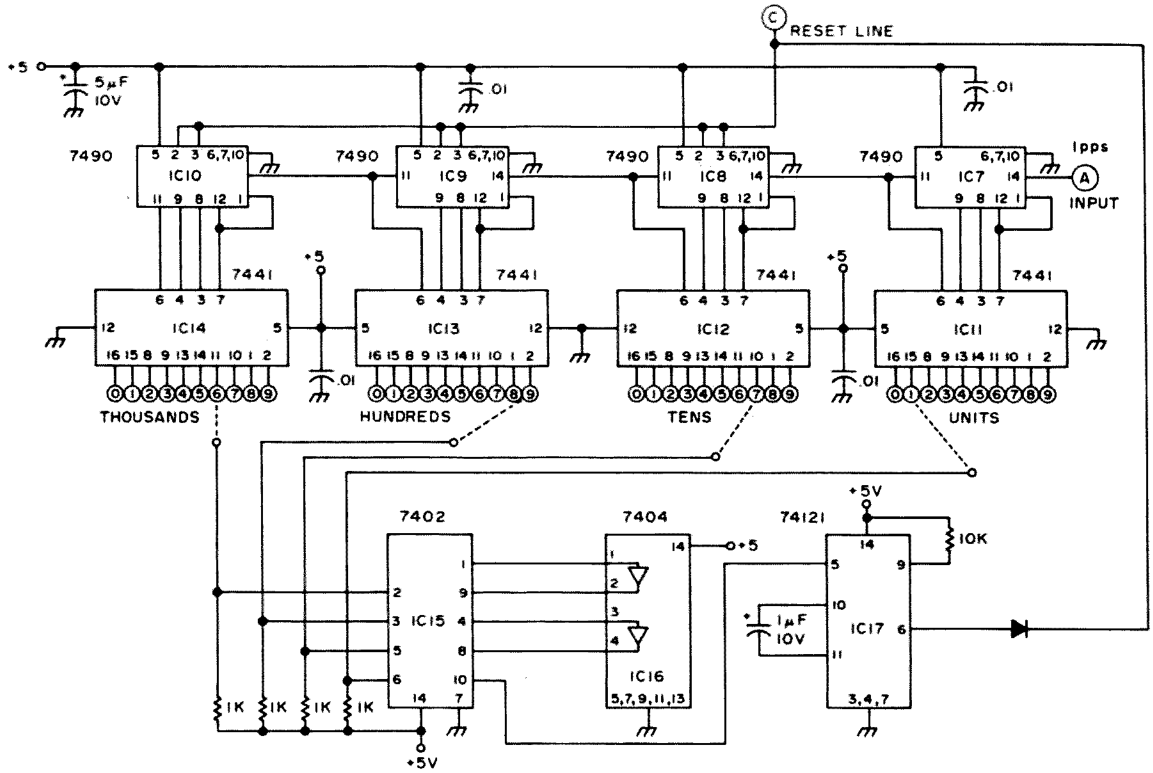


Fig. 2.

the proper reset signal when the count has been reached. NOR gates are used to provide this function. A NOR gate will have its output go high only when all its outputs have gone low. IC15 is a quad 2 input NOR gate, meaning that it contains 4 NOR gates, each with 2 inputs.

Programing the timer involves connection of the proper decimal outputs of the 7441s to two of the gates in this package. NOAA 3, with an orbital period of 116 minutes 11 seconds, will be used as an example. This orbital period represents a total of 6971 seconds and when this count has accumulated we want the counter to reset. Fig. 3 shows the logic diagram of the sensing and reset circuits. The inputs of the two ICs are held high by resistors connected to the positive supply. When the counters are all at zero the selected outputs of the decimal converter (6-thousands, 9-hundreds, 7-tens, 1-units) are all high and the outputs of both NOR gates are therefore low. As the count reaches 6000 the 6 output of the "thousands" decimal converter goes low, taking one input of gate 1 low. The output of gate 1 is still low, however, since a NOR gate requires all inputs to be low if the output is to go high. When the count reaches 6900 both the inputs to gate 1 are low and its output goes high. This high is inverted by one section of a hex inverter (IC16) thus becoming a low which is applied to one input of gate 3. At this point however, both inputs of gate 2 are still high and its output is therefore low. This low inverted by another inverter becomes a high applied to the other input of gate 3, thus keeping the output of gate 3 low. When the count reaches 6970 one input of gate 2 will pull low but the gate's output will remain low. When the count reaches 6971 both inputs of gate 2 are low and its output goes high. The inverted output of gate 2 lowers the remain-

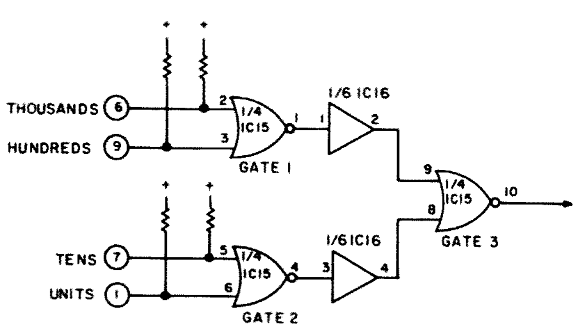


Fig. 3. Details of the orbital timer reset circuit. The output of gate 3 goes high only when the thousands, hundreds, tens and units inputs to gate 1 and 2 go low at the end of the programmed orbital period.

ing input of gate 3 which then goes high at the output. Thus, the only time the output of gate 3 will be high is when a count of 6971 is stored in the decade counters and decimal decoders. This high could be used directly to reset all of the counters in the unit but improper reset would be likely since there are so many counters involved. The high at gate 3 of IC15 is thus used to trigger a 10 ms single shot (IC17). The 10 ms output of the multivibrator is sufficiently long to assure that all of the counters in the unit will reset. The programing used in this example is indicated by dotted lines in the schematic. Other orbital periods can be accomodated by changing the connections between IC15 and the appropriate outputs of IC11-14. One second was chosen as the basic time base because it provides reasonable accuracy with moderate circuit complexity. The orbital programing should be chosen on the basis of the nearest whole second. A worst case situation thus involves a maximum error of 0.5 seconds per orbit. Under such conditions the timer would run approximately six seconds slow or fast each day, assuming 12 orbits per day. The counter would be one minute off every ten days. The closer the true orbital period to a whole second, the greater the accuracy. In the worst case shown above, assuming one minute as the maximum allowable error, the counter could be reset a minute early every ten days if running slow or the count keyed out of the counter for one minute if it were running fast.

The display circuit, Fig. 4, consists of three decade counters (IC18-20) driven by the one pulse per minute output of the time base. Each decade is connected to a BCD/7 segment decoder (IC21-23) which drives a seven segment LED numeric display. A reset pulse from the orbital timer resets the display to 000. Once each minute the display will be updated. In the case of the NOAA 3 orbit used as an example, the display would accumulate to 116. Eleven seconds after the initial display of 116 the display would reset to 000 and a new orbit begins.

Construction

Although the final unit can be packaged in any way desired, it simplifies construction and trouble-shooting if each of the three subassemblies are constructed on separate boards. Glass perf board with .1" hole spacing is ideal for this purpose. IC sockets are highly recommended even though they do increase the cost of the project. Normal digital construction practices should be followed. Bare #18 tinned wire may be used for the 5 V, ground, and reset busses with smaller wires used to interconnect ICs and routings to each bus. Do not scrimp on the bypass capacitors indicated, otherwise the

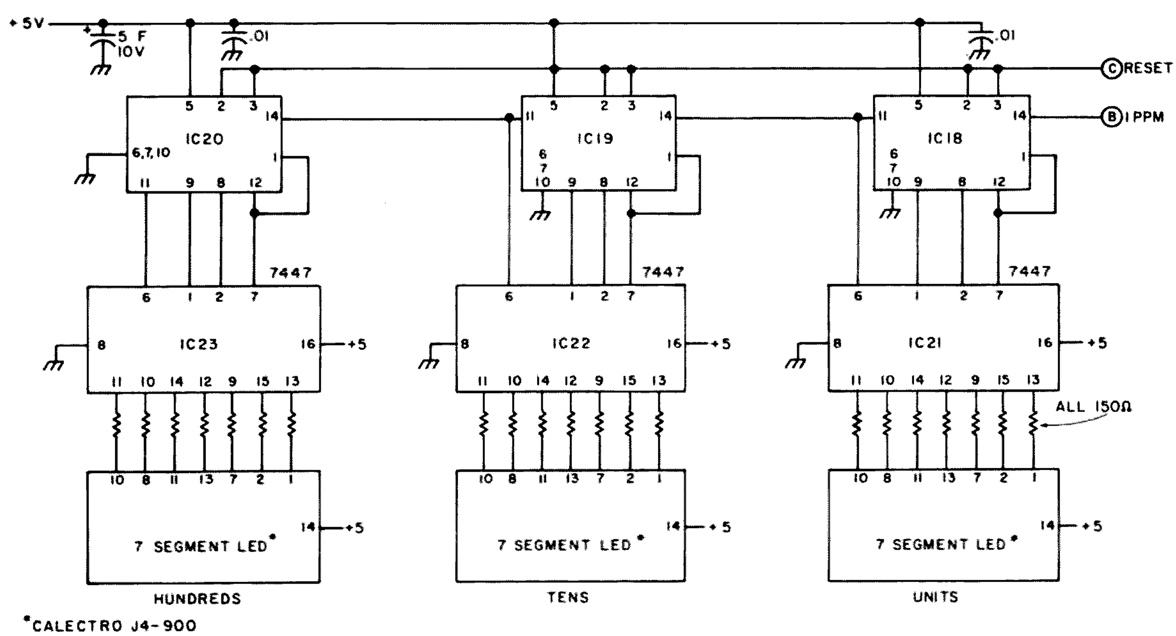


Fig. 4. LED display — minutes since equatorial crossing.

counter will react unfavorably when the transmitter, clothes dryer, or any one of the many possible rf and noise sources in the house are used. The 5 V line from each board should be returned to the common 5 V point on the power supply (Fig. 5) and the same thing for ground lines. Do not ground each board to the chassis! It is recommended that each board be built and tested on the bench using test leads. Once it is determined that each is functioning, they can then be wired into the complete unit with confidence. Begin by constructing the power supply, followed by the base board. With the time base board connected to the 12.6 V ac and the 5 V and ground lines the small indicator LED should flash on and off at a 1 second rate. A voltmeter on the output of IC6 should show a logic high (2.4 V min.) every minute. Note the time when the output goes high, disregard when it drops and note when it rises again – the interval should be 60 seconds.

The next board constructed should be the display. The LED display units mount on 14 pin DIP sockets. By proper positioning of the LED sockets the board can be mounted behind the front panel with a cutout for the LEDs. If you go this route be sure the hundreds indicator is on the left, the tens in the middle, and the units indicator on the right as viewed from the panel. It sounds simple but you will feel very foolish if you have to read your numbers backwards! When the board is finished and checked install all the LEDs and IC 18 and 21. Connect a test lead from the 1pps output of the time base to the input (pin 14) of IC18. Connect the reset circuit of the time base to the reset line of the display board and set S1 to reset. Apply power and the LED should read 0. Switch S1 to run and the LED should count from 0-9 with the count updating every second. If it counts out of sequence or some numbers are incomplete, recheck wiring. If the wiring seems OK and you still have an aberrant count try substituting the LED and IC21. Be sure power is off before changing ICs at any point in the testing procedure. When the first counter checks out remove IC21 and 18 and put in IC19 and 22. Change the 1pps input to the input of IC19 and repeat the entire test procedure. Remove 19 and 22 and insert 20 and 23. Repeat the entire test sequence with the 1pps test lead routed to the input of IC20. When all three display decades have been checked, replace all ICs, route the 1pps input to the input of IC18. Place S1 in reset and apply power. The display should read 000. Return S1 to run and you should observe a nice orderly count. At the end of 1 minute it should read 060, at the end of two minutes it should be 120, etc. As a final test set S1 to reset and connect the test lead from the input of IC18

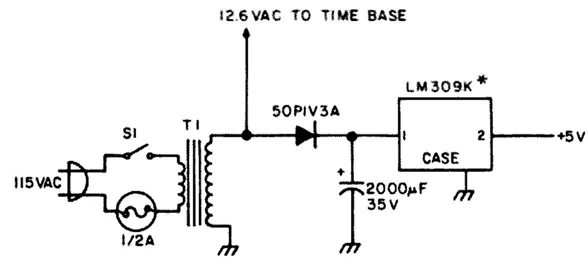
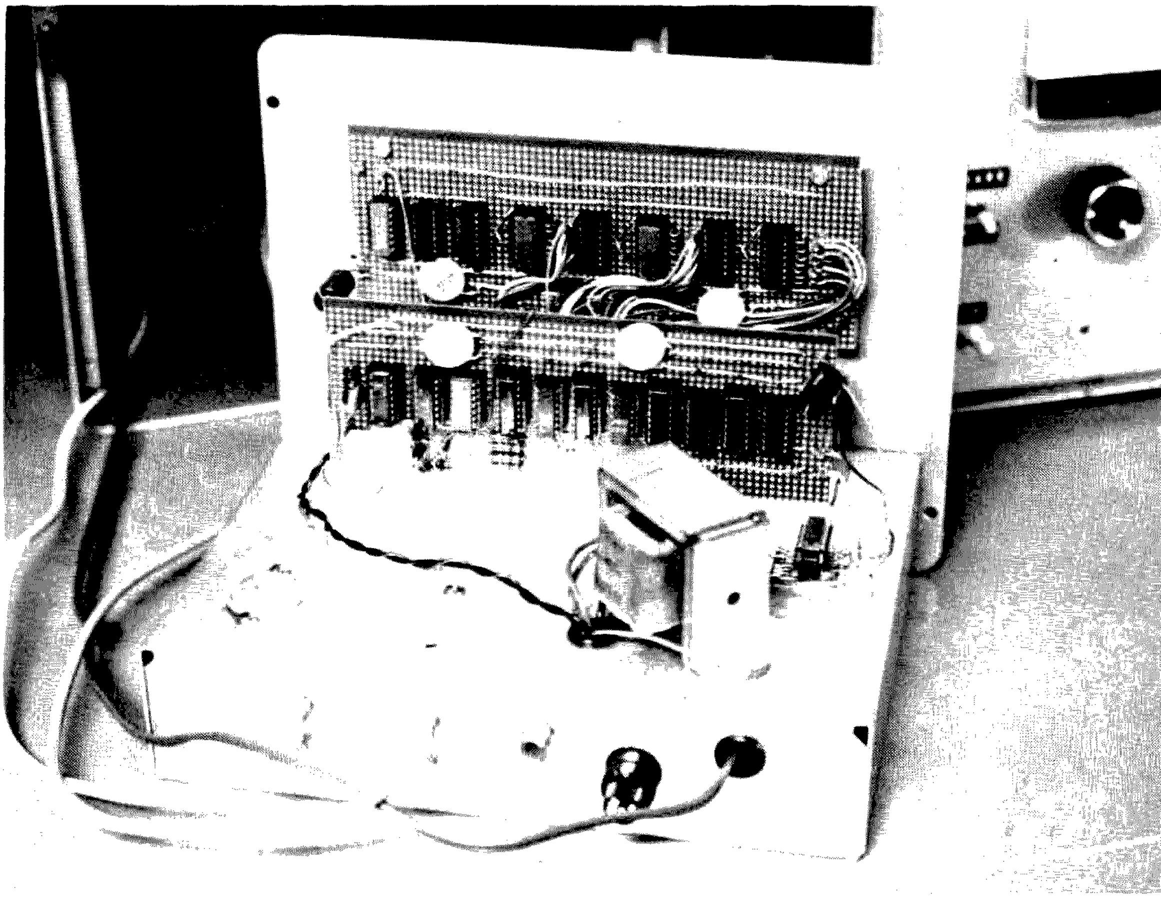


*Fig. 5. T1-12.6 V 2A., S1, SPST, power. *Regulator IC should be mounted on a good heat sink using mounting grease: All polarized capacitors are electrolytics. All decimal capacitors are low voltage disc ceramic units. All resistors ¼ or ½ W, 10%. Unmarked diodes are general purpose silicon (IN457, IN914, etc.).*

to the 1ppm output of the time base. Return S1 to run and the count should now occur at the one minute rather than one second rate.

Construction of the orbital timer is the final step. When it is finished it should be interconnected to the 5 V, ground, and reset lines along with the other two boards. Since we don't want to wait around all day to determine if it is operating properly, connect the 1pps input of the timer to pin 8 of IC1. This has the effect of speeding up the count by a factor of 60 (60 Hz input to the timer instead of 1 Hz). When wiring the timer you should select the programing on the basis of the satellite you plan to track. At our speeded up test rate a 116 minute 11 second orbit (used as an example in our earlier discussion) will now occur in just over 116 seconds. While testing the timer, temporarily connect the 1ppm input of the display board to the 1ppms output of the time base. Set S1 to reset and return it to run. The display should start at 000 and advance one unit every second. At the speeded up rate it should reset almost immediately after it



An interior view of the satellite timer. In this version a portion of the time base (the 1 minute count down chain) has been incorporated as part of the display board mounted up against the front panel. The time base ICs, the display 7490s and the decoders are visible while the 7 segment LEDs are on the other side of the board facing the panel cutout. The orbital timer and reset circuits are on the chassis mounted board. The 1 Hz monostable is mounted on a small sub-assembly behind the power transformer. The 60 Hz to 1 Hz timebase circuitry is mounted on a small board beneath the chassis. The cables plugged into the rear apron carry control signals from the orbital timer to automatic control units in the weather satellite station.

reaches 116 (in the case of our example). If it resets at some other value you should double-check your program wiring, if it fails to reset double check the wiring. If all appears well you should follow the signal through the count chain checking for proper logic levels at each point. This is the fastest way to uncover a bad IC – virtually the only thing that can keep a properly wired unit from operating. Once all boards are working you can mount and wire them into the completed unit.

Putting the unit into service involves calculating the nearest convenient equatorial crossing time for the satellite of interest. Set S1 to reset and at the calculated equatorial crossing time return it to run. Spot check the timer for the first few weeks to get an idea of how quickly it is drifting either fast or slow to get an idea of how often you will want to reset it. You will find that calculating one or two crossings a month is much easier than amassing the data every day. Since both weather satellites and OSCAR satellites are in sun synchronous orbits, the time of equatorial crossing can be neatly related to the point that the satellite crosses the equator. Listening to one or two bulletins will provide the raw data you need to convert time of crossing to the point of crossing and a graph can be prepared. With the crossing time available from the timer the graph can be used to orient the satellite track on the plotting board and you are ready to track using the timer as your time base.

If there is sufficient interest, it would be possible to prepare a short article on tracking techniques – let 73 know if you would like to see such an article. A future article in this series will show some of the automated weather satellite equipment that can be interfaced with the timer. This will include turning on the recorder at preset points in the satellite orbit during the daily "windows" and automated antenna tracking. With this sort of equipment the satellite station can operate while you are away at work or even a month's vacation and the pictures will be waiting when you return.

...WB8DQT

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CQ OSCAR 7

An Introduction to OSCAR Satellite Operation

Four minutes to acquisition of signal. Three minutes, two minutes, one minute. Are these the sounds of a NASA satellite control room? Not necessarily. They just might be the thoughts of a radio amateur as he sits at his operating position waiting for the next OSCAR satellite pass.

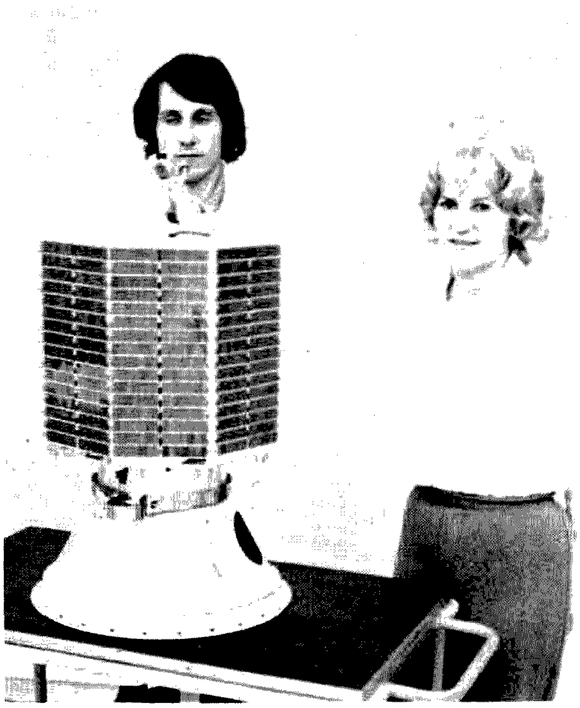
If you have receiving equipment for 80-10 meters and haven't listened for OSCAR 6 as yet, you are missing one of the new and exciting facets of amateur radio. This article describes how you can get started, equipment requirements, frequencies and when to listen.

Basically, AMSAT-OSCAR 6 is a linear translator in a 910 mile polar orbit that retransmits the CW and SSB signals it picks up in the band 145.900 to 146.000 MHz down to the 29.450 to 29.550 MHz band. The 910 mile orbit gives this repeater in space a range of communication of about five thousand miles. Truly amazing when you consider the ten meter transmitter runs less than a watt.

AMSAT-OSCAR 7, launched November 15, 1974, is very similar to OSCAR 6 with the addition of a linear translator with a receiver on 432 MHz and a transmitter on 144 MHz. The exact frequencies for both satellites are listed in Table 1. As you can see, OSCAR 7 has several more translators and beacons than OSCAR 6. To accomodate the translators, command and control modules and batteries, OSCAR 7 is larger than its predecessor. OSCAR 7 is 17 inches high and has an octahedral crossection of 14 inches. The photograph of Jan King W3GEY and AMSAT-OSCAR-B (OSCAR 7) should give you a good idea of how small a satellite can be. Specific details on the capabilities of OSCAR 7 can be found in the references at the end of this article.

Getting Started

The best way to get started in satellite communications is to listen to several satellite passes. Most any receiver capable of



Jan King W3GEY (Project Manager) and Marie Marr (AMSAT's aerospace technician) pose with the AMSAT-OSCAR-B satellite.

receiving 29.45 to 29.55 MHz is fine to begin with. To insure your receiver is at its best, you should consider peaking the rf amplifier for reception at 29.5 MHz. The crystal calibrator is a handy signal source for

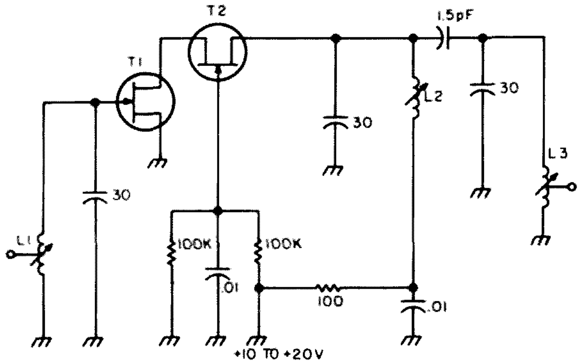


Fig. 1. A simple 10m preamp. T1, T2 MPF 102, MPF 106, 2N4416 L1, L2, L3 Identical 1.2 uH, 11 turns #26 enameled wire on 3/16" slug tuned form. Tap Li, L3 at 3 turns.

this operation. Additionally, for serious satellite work, you'll probably need a good ten meter preamp.

Fig. 1 shows a simple preamp useful on 10 or 2 meters, with appropriate coils, of course. Although this design uses two FETs, it needs no neutralization, which is handy. It can be constructed in a mini-box or on a small printed circuit card and placed in your receiver. Any ten meter signal can be used to tune it up.

The preamp will insure that you can hear both sides of each QSO in progress on the satellite when you listen in. This is an excellent test of your receiving set up.

On ten meters I use three antennas, but to start out, any low band antenna will do. When the satellite is low on the horizon I use a 3 element 10 meter beam. For overhead passes I switch to a 10 meter dipole or ten meter vertical. The switch is a wafer type in a mini-box. The vertical has no radials to improve the high angle radiation.

Another test for your receiver is that when OSCAR 6 is in range, you should be able to hear considerable noise in your receiver passband. This is the retransmitted noise from the satellite's receiver.

After listening to several passes, you'll probably want to make some contacts using OSCAR 6. To work through the two to ten meter repeaters of both satellites, one hundred W effective radiated power is recommended. A Johnson 6N2 or Ameco TX-62 at fifty W with 100 feet of RG-8 and a four element beam is one acceptable approach. Good results have been achieved with keying a 10 W 2 meter FM rig on CW and an eleven element beam. Although some satellite users have both azimuth and elevation control, a simpler but very effective compromise is to elevate the VHF antennas by 30 degrees. The antennas I use are shown in Fig. 2.

Operation

To make contacts you'll need to hear your two meter signal as it is retransmitted down to your ten meter receiver. The normal procedure is to send a series of dahs while tuning your receiver until you find yourself. Now you can compare your signal against the other signals in the passband and adjust your power input accordingly. Remember all of the signals in the output of the satellite are sharing the one W in proportion to their strength at the satellite's

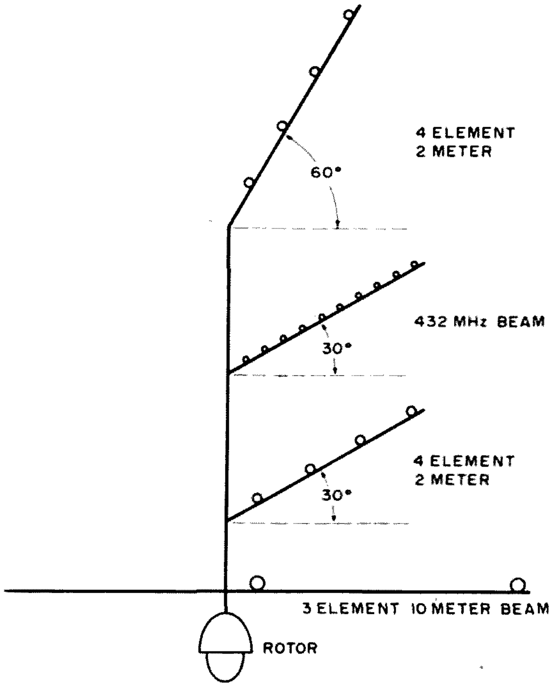


Fig. 2. OSCAR 6 and OSCAR 7 antennas at W3HUC.

receiver. Excessive power by one user may overload the satellite's AGC and reduce the strength of other user's signals, thereby causing interference and possibly disrupting QSOs in progress. The FCC has interpreted overloading the satellite as a violation of section 97.67 (b) of the Rules. By monitor-

Fred W2GN displays his compact mobile OSCAR satellite station.

ing your return signal, you can easily avoid such problems.

When To Listen

Determining when OSCAR 6 or OSCAR 7 is in range of your location is much easier than you think. In fact, after a few nights of listening to OSCAR you'll probably be able to calculate the passes for the following evening in your head. Oscar 7 has a similar orbit to OSCAR 6. Thus, what you learn for OSCAR 6 will also be useful for OSCAR 7.

OSCAR 6 orbits the earth at an altitude of 910 miles and when it crosses the equator heading north (ascending node), it makes an angle of 101.77 with the equator. The first ascending node orbit after 0000Z has been designated the reference orbit. The time the satellite crosses the equator, point A in Fig. 3, on each day's reference orbit is published in the *73 Magazine* AMSAT News Column and in the *AMSAT Newsletter*, or from AMSAT by sending a self addressed stamped envelope to: AMSAT, P.O. Box 27, Washington, D.C., 20044 for two months orbital data.

The reference orbit information consists primarily of an equator crossing time and degrees west of Greenwich the equator

Table 1
OSCAR 6 and OSCAR 7 input, output, beacon and station receiver requirements

	UPLINK (MHz)	DOWNLINK (MHz)	RECEIVER (28 MHz i-f)
OSCAR 6	145.9-146.0	29.450-29.550	29.450-29.550
BEACON		29.450	29.450
OSCAR 7	145.850-145.950	29.40-29.50	29.40-29.50
	432.125-432.175	145.975-145.925	29.975-29.925
BEACONS		29.5	29.50
		145.98	29.98
		435.1	31.1
		2304.1	

crossing will take place. As an example, the information below for orbit 9121 shows that

REV	DATE	GMT	LONGITUDE W.
9121	14 OCT 74	0135	72.1°

OSCAR 6 crossed the equator at 9:35 PM EDT at 72.1° west longitude on Sunday evening, October 13, 1974. From experience, I knew that at about 9:40 PM on this date I would begin to hear stations south of me in QSO via the satellite.

Once you know the pertinent information which occur in the evening, there are also descending node orbits which occur during the morning hours. By using simple calculations, you can determine the time required for the satellite to travel from its equator crossing on the other side of the earth to a point where you can access it. The example in Fig. 4 places the satellite on the equator at 260.9° west longitude at 14:11Z. At approximately 14:40Z the satellite will reach its most northern point and begin its southward journey over North America reaching the equator at 15:09Z. These times can be determined by adding one quarter

Table 2
AMSAT nets provide information to new satellite users

FREQUENCY	AREA	TIME	NET CONTROL
3850 LSB	No. America East	Monday 9PM EDT (0100Z Tues)	W3ZM
3850 LSB	No. America West	Monday 7PM PDT (0200Z Tues)	W6OAL
14280 USB	International	Sunday 1800Z	W3ZM
21280 USB	International	Sunday 1900Z	W3ZM
3780 LSB	Western Europe	Sunday 0915Z	G3IOR
3560 LSB	JA Net	Monday 1300Z	JA1ANG
14320 USB	SE Asia	Thursday 1300Z	JA1ANG
3850 LSB	ZL Net	Mon., Thur., Sat. 7PM NZT	ZL1WB

for a reference orbit, it is easy to determine the remaining orbits for that day and, in fact, for the rest of OSCAR 6's life. Since the satellite's period is 144.99455 minutes, all that you need do is add one hour and fifty-five minutes to the reference orbit equator crossing to get the second crossing of the day.

To determine where the satellite will cross the equator simply add 28.7° to the first equator crossing as shown below.

REV	DATE	GMT	LONGITUDE W.
9122	14 OCT 74	0330	100.8°

This is easily explained since the earth is spinning under OSCAR 6. During the time it takes OSCAR 6 to return to the beginning of its orbit, the earth has moved 28.7° to

$$\frac{114.9455}{24 \times 60} \quad 360^\circ \quad = 28.7487^\circ$$

the east. Thus, the satellite appears to have moved to the west.

In addition to the ascending node orbits and one half of an orbit period, respectively, to the time of the start of the orbit.

$$\frac{114.994}{4} = 28.748 \text{ min.}$$

$$\frac{114.994}{2} = 57.497 \text{ min.}$$

The satellite will cross the equator at 95.3° west longitude, as determined from the following equation:

$$260.9^\circ - 180^\circ + 14.37 \approx 95.3^\circ$$

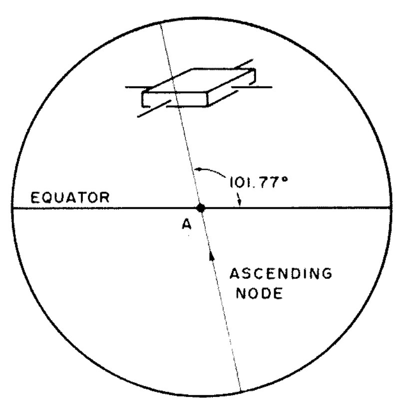


Fig. 3. Ascending node (northbound) equator crossing.

$$\frac{28.7487}{2} = 14.37^\circ$$

To complete this example, assume your location is approximately 90° west longitude and latitude such that you normally hear the satellite five minutes after an ascending node equator crossing. Therefore, for a near overhead pass, as in this example, you should begin to hear the satellite twenty five minutes before it reaches the equator. For the next twenty minutes until 15:04Z you should be able to access the satellite. Obviously, if you are significantly east or west of this location for this particular pass, the access window would be much shorter than twenty minutes.

Listed in Table 2 are the AMSAT nets where specific questions you may have will be answered for you. The nets provide up to date information for both newcomers and regular users on such items as the status of OSCAR 6, launch date for OSCAR 7, etc. For example, at the time this article was written, OSCAR 6 was turned on at 0000Z for twenty-four hours on the following GMT days: Mondays, Thursdays and Saturdays. During the summer, descending node (southbound) passes for OSCAR 6 were turned on for Sunday mornings. During the school year, Tuesday and Friday morning passes are turned on for use as an educational tool. If the satellite's battery voltage is sufficient, both the weekday and weekend descending node orbits will be available. OSCAR 7 has been designed with a positive power budget and should be available for more orbits than OSCAR 6. The AMSAT nets will still provide current information on special events for satellite users.

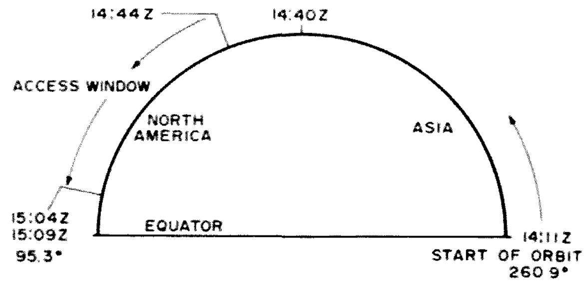
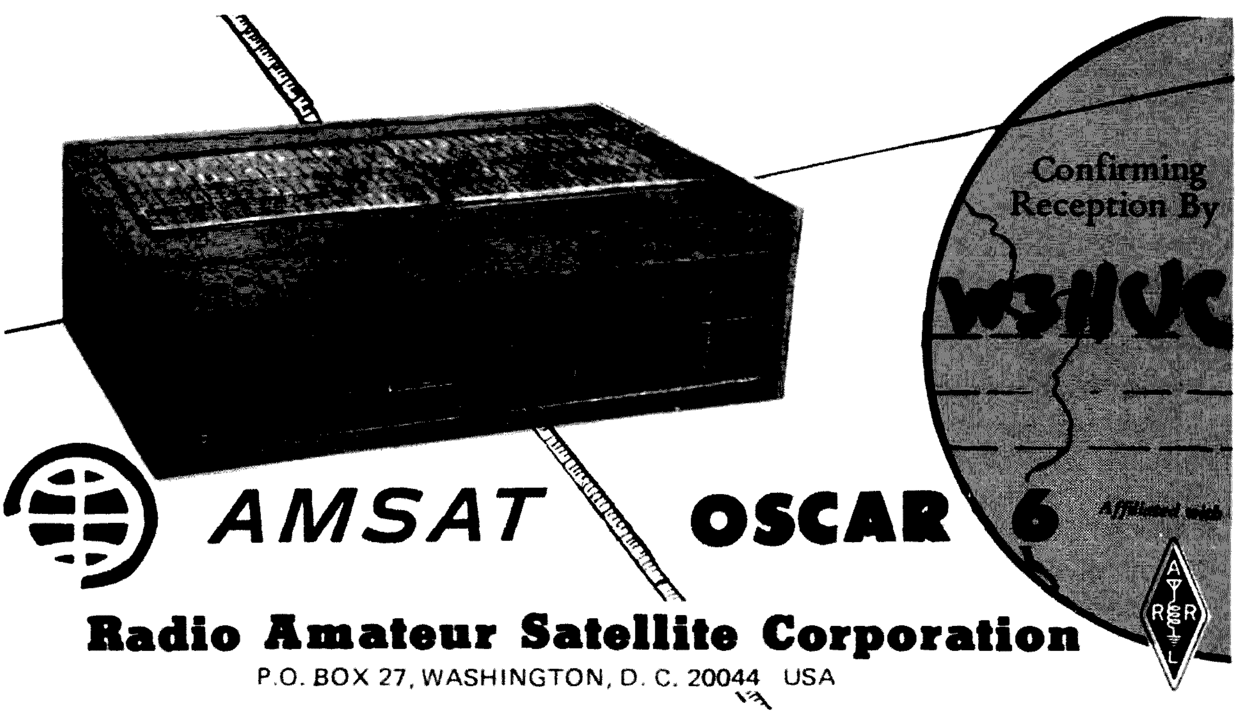


Fig. 4. Calculation of descending node access window.

Experiments

There are many simple experiments that can be accomplished using OSCAR 6 and 7. For example, an OSCAR amateur station and a frequency counter can be used to demonstrate that the moving satellite causes a Doppler shift on the downlink signals of plus/minus 5.7 kHz on the ten meter signals



OSCAR 6 QSL card that you can receive by sending a report to AMSAT that includes normal QSL information on stations you hear using the satellite.

An easier experiment is to determine the minimum ERP which still allows you to hear your own signal. There are many fascinating experiments that are possible from copying the CW telemetry, such as determining the spin rate of the satellite.

Results

Results on OSCAR 6 have been phenomenal. Well over 2400 amateurs have made over 100,000 two way contacts. This is a tremendous growth rate from the previous two satellites designed for two way communications, OSCAR 3 and 4. There were 98 successful users on OSCAR 3 and 11 users for OSCAR 4. Short lifetime was the primary reason for the limited use of these satellites; however, the experience gained by both the users and developers contributed to the success of OSCAR 6.

The list of countries you can work through OSCAR continues to grow. The last count shows that stations from 87 countries have made contacts through OSCAR 6. Prior to the launch of OSCAR 7, the number of stations who had attained the goal of worked all states had risen to sixteen.

In conclusion, whether you wish to write a special computer program for satellite use or study propagation from satellites for a high school project, the only limit is your imagination. If you are a DXer, then working out to the fringes of the satellite's capability for new countries may appeal to you. Whatever your amateur radio interests are, this is the time to apply them to satellite communications and discover both the enjoyment and challenge of this new frontier in amateur radio.

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How to Find a Satellite

A Simplified Graphical Technique for Satellite Orbit Prediction

The use of orbiting satellites by amateur radio operators is expanding rapidly. Amateurs were there to pick up the first beeps from Sputnik. Today with the Oscar series of satellites and the various weather satellites, the need for a simple orbit prediction method is increased. The technique used here evolved from such a need. I had been monitoring one of the Essa satellites for several months on weekends only. Each Saturday I monitored the receiver until I heard a pass. The next pass would be one hour and forty five minutes later. This accuracy sufficed for each weekend but the error in extending it to the next weekend was excessive. Broadcasts of equatorial crossings were available but that method appeared too complex. Surely a simpler method could be found that could be used when such broadcasts were available or not.

The answer was simple: to analyze experimental data you graph it and try to fit an

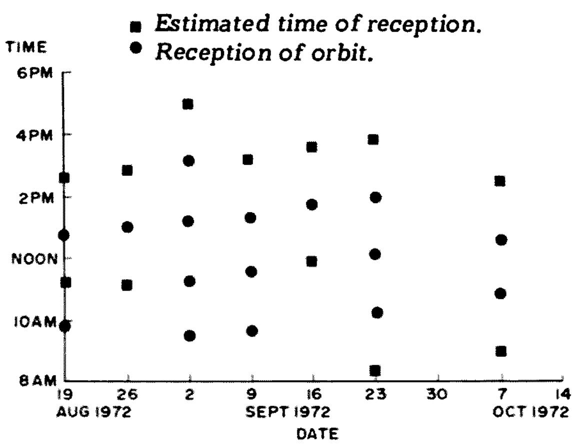

Fig. 1. Plot of Saturday receptions.

equation to it. So I graphed both the orbits I heard and the predicted times for the previous and next orbit. The graph for several Saturdays is shown in Fig. 1. The horizontal axis shows the date and the time of observation is on the vertical axis. Only daylight hours are shown because the satellite was solar powered. With several weekends plotted, I began drawing straight lines connecting the points from one Saturday to the next and extending them on to the following

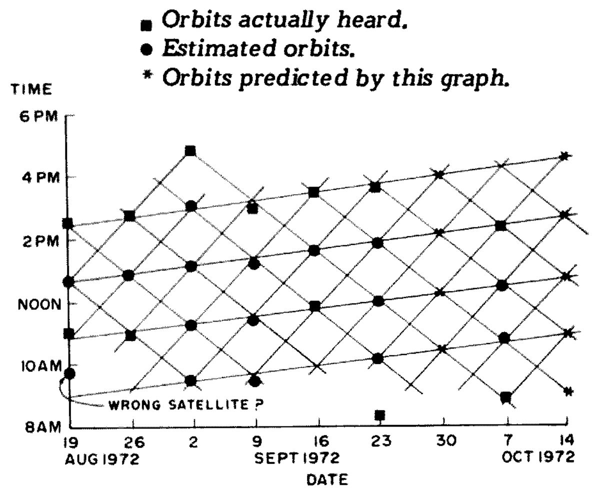

Fig. 2. Prediction lines for Saturdays.

Saturday. This is illustrated in Fig. 2. A pattern appeared. After all if the orbit is periodic then the pattern should be periodic. A similar gridwork was found for orbits heard on Sundays. The two grids are parallel. By extending the grid lines for any day, passes on that weekday in the future could be determined. The uncertainty of a prediction could be estimated by how well three or more prediction lines crossed. If they all cross at the same point, the accuracy is high. If they cross in an area several minutes high then the uncertainty is roughly equal to the number of minutes between the most separated lines. As more orbits are heard and plotted, the accuracy improves.

Reception times for days other than Saturday or Sunday can be determined as shown in Fig. 3. Here the results of two

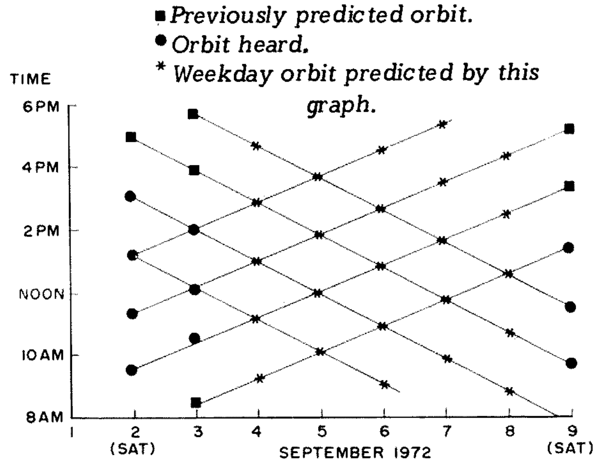

Fig. 3. Prediction of weekday orbits.

successive weekends are plotted. Drawing straight lines from one Saturday point through a Sunday point to a point on the next Saturday, a grid is generated. Where the grid lines cross each day a passage of the satellite should occur.

This method is simple, fast and easy on the brain. The power of graphing cannot be underestimated.

. . . WA4WDL

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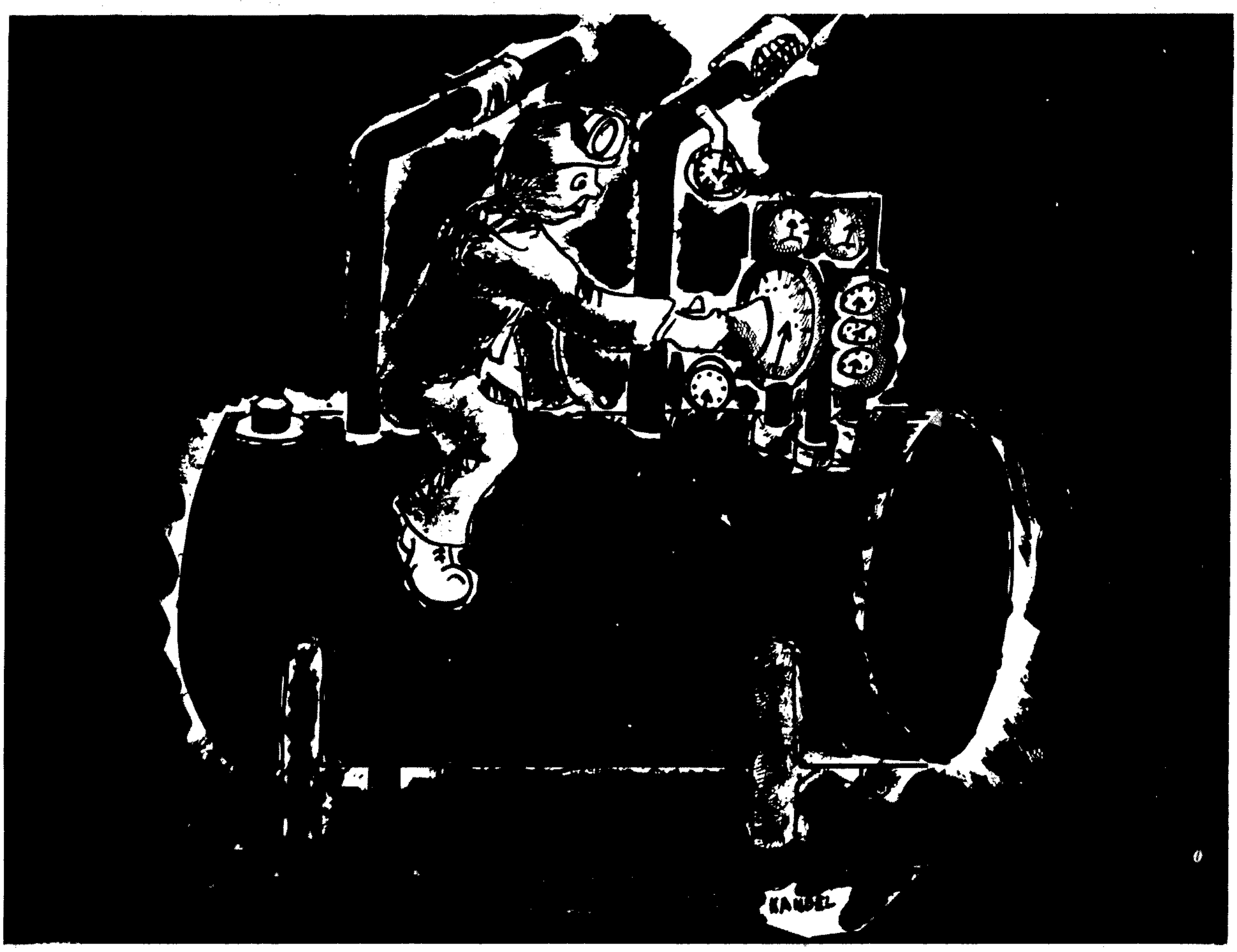
Measuring Heating Oil Usage

Now that winter is here again, and with it another fuel shortage (or, at least, that's the way it looks in October as this is being written), it's time for you to apply your electronics know how to the problem.

Measuring how much heating oil you use is not easy. If your oil tank has a gauge, the best it probably does is to tell you whether



you have a half-tank or quarter-tank. And if you have an outside tank buried under your lawn, maybe you don't have a gauge on it at all. But with just a few dollars' worth of parts, you can measure your oil usage day by day, or even by the hour.

A typical oil burner has an oil pump, which pressurizes the oil up to around 100 psi; the oil is then squirted into the firebox through a nozzle which is calibrated in gallons per hour. To determine the number of gallons used, you only need to know how long the burner has run. This is easy to do with a running-time meter, which measures elapsed time.

To do the installation, get yourself a 110 V running-time meter which can be read down to the nearest 1/10 hour or better. The finer the calibrations on the meter, the better. If a 110 V meter is not available, you can use other voltages if you add an appropriate transformer. You mount the unit in a box at a convenient location, and connect it directly across the burner motor. Now every time the burner runs, the time meter runs as well.

Although you can use the nozzle calibration as a rough starting point, for best results you should calibrate the meter yourself. This is easy to do by dividing the total elapsed time between two oil deliveries into the number of gallons consumed. Repeating this calibration a few times should give you a fairly exact figure for the gallons-per-hour usage of your burner; the calibration should be repeated, of course, each time you replace the nozzle.

Once you know the calibration figure, you can easily compute the number of gallons of fuel used for typical household tasks. For instance, if you find that the burner uses 1.1 gallons per hour of running time, you can calculate how much oil your XYL uses in her 1 hour shower. In order to get the best accuracy, during this time you should turn down your thermostats so that the burner is used only for heating the shower water, and not for heating the house. This may leave her slightly cold when she comes out, but you can explain that's necessary for the progress of science. If you then find that the burner ran for 0.7 hour, your figure for the oil needed to heat her shower water is 0.77 gallons.

Other uses are possible too. For instance, on an extremely cold day during the winter you might find that your house simply does not get over 60 degrees and you're freezing. If, during a 24-hour period, you find that the running-time meter has run 23.5 hours, then you can suspect that the boiler/burner combination is too small for your house. On the other hand, if it has run only 12 hours, then you can suspect that the boiler/burner size is OK, but the distribution system (such as radiators and circulator pump) is too small to get all the heat produced in the boiler distributed into the house.

Finally, if oil rationing should come about, you can keep track of your daily oil usage and, if needed, cut down on your usage in the early part of the month so as to leave enough oil for the last few days of the month. You may not have any more oil, but at least such a system will allow you to keep from running out of your allotment altogether.

...K2OAW

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Mod Squad Hits the SB-102

While working a lot of cw with my transceiver it soon became apparent that some control of the agc time constant and selection of agc to the "out" position would be desirable. Also, any modifications that are made should not require the drilling of new holes or marring of the front panel. In this way the unit could be restored to its original configuration.

This modification consists of adding two miniature switches on a small "L" shaped bracket which is mounted to the top right side of the LMO power supply cover utilizing the existing two self-tapping screws. A spst switch is used to control the agc time constant from either "fast" to "slow." The ground end of the existing 3300Ω resistor is raised from the printed circuit board and a small terminal strip is placed on top of the board under an existing screw that holds the circuit board to the chassis. The free end of the resistor is connected to the terminal strip lug. A wire connects from this tie point to the spdt switch as indicated in Fig. 1. At tube V13A, pin 1, the printed circuit foil is cut with an X-acto knife or razor blade. Two slices about 1/32" apart will give the required separation. Wires are now soldered to each side of the cut side of the cut foil and connected the dpdt switch as indicated. This is your agc "in-out" switch. Since the meter bridge circuit is now unbalanced when in the agc "out" position the meter will read below zero on the S meter scale. Not desiring to see meters read below zero the other pole of the dpdt switch was wired as shown. Now, when in the agc "out" position the meter will read zero as it should. This modification involves simply opening the existing black lead at the socket of V3 and placing the switch in series with the meter switch. With these modifications your transceiver will now have agc features normally found only on deluxe SW receivers. Use of the agc switches involves opening the hinged cover which is really no problem.

. . . WA2KHK

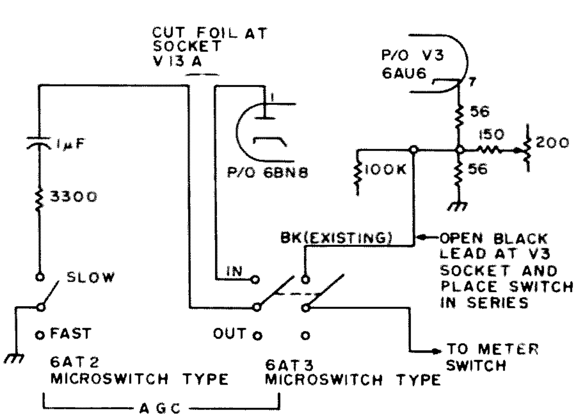

Fig. 1.

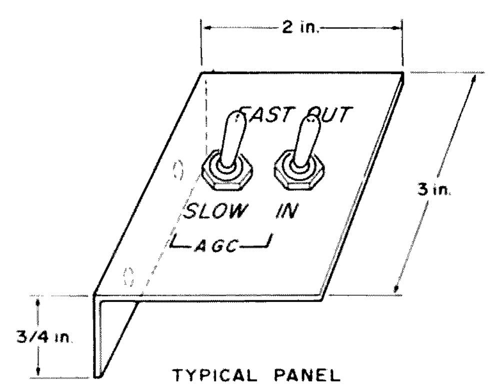

Fig. 2.

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FM vs AM - - -

which is REALLY BETTER - -

Recently, the use of FM on VHF has grown by leaps and bounds. So have the claims of the fans of this mode. Some have even told me that FM is superior to SSB for weak signal work. Perhaps it is time to objectively assess the relative merits of AM and FM under weak signal conditions. I will try to confine my bias to the title.

A few years ago, around Metropolitan Toronto, there were many 2 meter mobile AM stations. The average rig produced about 10W output. There were also many Twoers producing about ½W output. The popular antennas were halos and turnstiles. Along came the surplus FM rigs. Of course these commercial FM rigs did a better job. They had many things going for them.

1. The FM rigs produced about 40W output. Using the 10W AM rigs for comparison, that is 4 times as much power.

2. The commercial FM rigs used speech clippers as a guard against excess deviation. Hardly any AM rigs around here used speech clipping. You can get about a 10 times power advantage by using speech clipping.

3. The FM boys used vertical polarization. The AM boys used horizontal polarization. If you look at Fig. 8 in VE3AAZ's article in QST[1], you will see that a vertical antenna, 5 ft off the ground on a car, has a dB or so advantage over a horizontal antenna. For mobile-to-mobile operation, the FM boys have a 2 dB or so advantage. That is a power ratio about 1.6.

If we multiply these three power ratios, we have (4 x 10 x 1.6) a power advantage of 64. No wonder the FM boys do better than the AM boys. Note that none of these advantages are due to the FM mode. The AM boys could build rigs giving 40W out, use speech clipping and vertical polarization. So, the fact that the FM boys are doing much better than the AM boys says absolutely nothing about the relative merits of AM vs FM. The advantage is in the equipment, not the type of modulation.

A common claim for FM is that it is better in the presence of noise. This is valid or not, depending on how you look at it. Every respectable FM receiver has a limiter, which helps to reduce the noise. An AM receiver can also use a limiter. The FMers have an advantage because they can clip their waves as much as they want. The AMers must not clip too much or they will distort the desired wave. For AM, you must be able to control the degree of clipping to fit the amplitude of the wave in the receiver. Noise clipping is available to the FM man and the AM man, but it is easier for the FMer to use this technique.

Bandwidth plays a big part in noise suppression. If the noise is the high amplitude, short duration type, such as ignition noise, a wide bandwidth is better. Narrow bandwidths reduce the amplitudes of the pulses and increase the time during which they are present. This makes limiting less profitable because you are chopping off a smaller part of the pulse. Therefore, when impulse noise is the limiting factor, the wider bandwidths of the FM system are preferable to the narrower bandwidths of the AM system. But even this is not necessarily true. Better impulse noise suppression in either system can be obtained with some sort of noise silencer applied before the filters in the i-f amplifier. With such a silencer, the bandwidth of the i-f amplifiers would not be significant for this type of noise.

In the presence of random noise with low peaks, such as receiver noise, the situation is quite different. The power of such noise is proportional to the bandwidth. Twice as much bandwidth produces twice as much

noise in the i-f amplifier. So the wideband FM system has a disadvantage to overcome. Comparing a 30 kHz FM system and a 6 kHz AM system, the AMers have a 5 to 1 power advantage with receiver noise before the signal gets to the detector. Clipping such noise is not nearly as effective as the clipping of impulse noise and both systems can use clipping anyhow.

The most interesting and significant characteristic of FM, in my opinion, is the capture effect. It is a factor characteristic of the mode itself. The factors noted above (bandwidth, use of clipping, etc.) were characteristics of the way in which the mode was used. When two signals are present in a system, the little one distorts the big one in amplitude and phase. The amplitude problem is reduced in the FM system by clipping. The phase distortion produces a more interesting story. If you do some vector analysis, as outlined by Terman[2], you will see that for a given ratio of signal amplitudes, the ratio of resulting deviations at the detector is large. That is, the little signal may be only a bit smaller than the larger signal in the i-f system but it will be much smaller after it gets through the FM detector. Even if a little signal is only slightly smaller than the big signal it will be clobbered by the detector.

Before the FM boys start celebrating, I should point out that it works both ways. When the desired signal is the biggest one, your signal captures the channel and you are the big winner. When the desired signal is the weaker one, as is often the case in ham radio, you lose your shirt. The performance in the presence of noise is similar. When the signal is stronger than the noise, the noise is suppressed. When the noise is bigger than the signal, the signal is suppressed. So there is a relatively sharp threshold of signal strength between solid copy and hopeless QRN.

The capture effect is most pronounced when the modulation index is high. For performance in noise, this means that a high modulation index, and therefore more deviation and bandwidth, gives more suppression of the weaker signal. Therefore, wideband systems have sharper thresholds of minimum signal strength, but this does not mean that you can receive weaker signals. A 1 to 1 signal-to-noise ratio is still the threshold.

The factor of the modulation index also produces different results at different audio frequencies. The relationship between the deviation and the modulation index is shown in the following equation.

$$\text{modulation index} = \frac{\text{deviation}}{\text{modulation freq.}}$$

For a given deviation, lower modulation frequencies give higher modulation indexes than do higher modulation frequencies. That is, under weak signal conditions, noise suppression will be better for the low audio frequencies than for the high audio frequencies. Since the higher audio frequencies carry most of the intelligence, this is an important matter.

The higher audio frequencies are in bad shape in the presence of noise in any system. Random noise (receiver noise) varies according to the bandwidth. There is as much noise between 500 Hz and 600 Hz as there is between 2500 Hz and 2600 Hz. On the other hand, the human voice puts most of its power in the lower frequencies. The higher audio frequencies suffer a poor signal-to-noise ratio in any system.

To give the higher audio frequencies a fighting chance, the FMer uses pre-emphasis and de-emphasis. In the transmitter, the higher audio frequencies are made bigger than the lower frequences (pre-emphasis). This gives the higher audio frequencies a better chance against the noise. In the receiver, the higher audio frequencies (and the noise at these frequencies) are reduced to restore the original relationship in the speech. This trick can be applied in an AM system, but hardly anyone does. The FMers do it not only because it is a good idea for any system, but because they get a double benefit. Not only do they get more deviation at the higher audio frequencies, but the greater deviation gives better noise suppression in the other guy's detector. That is, in the receiver audio system, there is more signal and less noise.

So it is time to try to sum up. Let us assume that we have an AM transmitter and an FM transmitter, both running a legal 1 kW. If we are comparing the two systems alone, the differences are these:

1. The FM signal has a poorer signal-to-noise ratio in the receiver i-f amplifier due to the wider bandwidth. If the FM system uses 5 times as much bandwidth, it suffers from 5 times as much noise power.

2. If the signal-to-noise ratio in the i-f amplifier for the FM signal is just a bit better than 1 to 1, the noise will probably be suppressed so much that the signal will be readable. The detector in the AM system does not improve the signal-to-noise ratio.

With equal transmitter powers, when the FM receiver has a 1 to 1 signal-to-noise ratio (its threshold) the AM receiver has a 5 to 1 power signal-to-noise ratio. So, I submit, the debate should be on the question of whether an AM signal, with clipping and pre-emphasis, can be copied when the power signal-to-noise ratio is 5 to 1. That is a bit over 1 s-point. From my observations on 2 meters, I would say that AM signals two s-points out of the noise are easily readable. With clipping, which is hardly ever used around here, signals one s-point out of the noise should be readily readable. Signals weaker than one s-point out of the noise should be readable with difficulty. Just where the threshold of readability is for AM signals is a matter for debate, but surely the difference between the two systems for weak signal work is small.

You might object to comparing two 1 kW transmitters, so let us deal with the transmitter conditions. What is a fair comparison depends on your point of view. If money is not a problem, you run all the power that the law allows. The above analysis assumes this sort of condition. If you are comparing the two modes with the same final tubes, FM has a small advantage. Tubes usually are rated for more plate dissipation for FM than for plate modulated AM. For a given dc power input, AM also requires a higher peak power capability than does FM. If you want to compare total power drain, AM needs not only the carrier power but almost as much modulator power, if heavy clipping is used. That figure of ½ the carrier power for the modulator that is usually used, is based on sine wave modulation, not clipped speech. Therefore, the cost factors in the transmitter are very much in the favor of FM.

FM is a fine mode when you are sending to the general public (broadcasting) or for those who use radio for business (taxis, police, etc). Such people have little patience with signals that are not free of noise. FM can offer noise-free reception even when the signal is only a bit stronger than the noise. But hams are communications nuts. They love to dig in the noise to work a distant station. We should not assume that FM is best for us just because the commercial VHF mobile services use FM.

If you really want a superior mode, there is always SSB or CW. SSB, particularly with rf clipping in the transmitter, is definitely superior to AM or FM for weak signal work, but that is another argument. If SSB is too rich for your blood, how about some double sideband, suppressed carrier, with clipping? Since the QRM on VHF is no great problem, almost any communications receiver can do an adequate job on sideband, following a crystal controlled converter. A DSB transmitter with clipping is not very hard to build.

Repeaters changed the situation completely, of course. Sideband, single or double, is not practical via repeaters, leaving us with AM or FM. The large amounts of surplus commercial FM equipment got amateurs started with FM and repeaters, so naturally when equipment built for hams came along, it too was FM.

If it hadn't been for repeaters it seems likely that sideband would have eventually forced the other modes to give way since it is inherently superior where there are no repeaters to extend the range of "base" stations. But all is not DX on 2m and thus repeaters and FM have just about completely eliminated the competition in virtually every part of the country.

At any rate – the next time a dyed-in-the-wool FMer starts talking about the tremendous advantages of FM over other modes, you will have some ammunition to make the contact interesting – interesting for *you*, at least. ...**VE3DNR**

References

1. *"Antenna Behavior Over Real Earth,"* Walter H. Anderson, VE3AAZ, QST, June 1965, p. 61.

2. *"Electronic and Radio Engineering,"* F. E. Terman, McGraw-Hill, p. 962.

George R. Allen W1HCI
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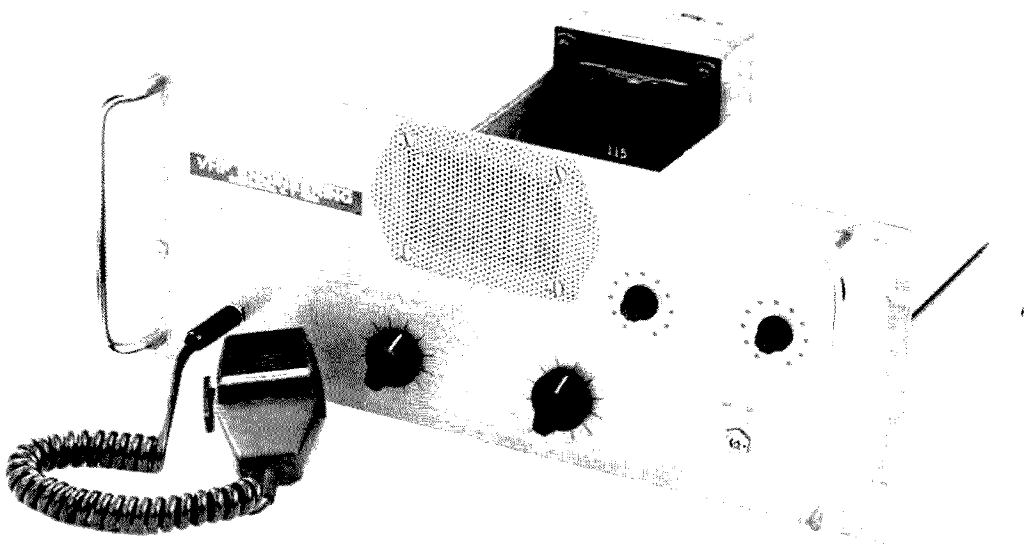


Build Your Own Repeater - for only $365

VHF Engineering Kits Simplify Construction

Construction of a repeater has been difficult and complex by tradition. This is not because repeater construction must be difficult and complex, but because it just sounds hard. In addition most repeater builders have not used an adequate repeater design, have made poor equipment choices, and have encountered horrendous problems of their own making. The fact is that repeater construction is simple and straightforward provided that a sound design is used and a practical construction approach is taken. We herein describe a simple approach to repeater construction and provide a pattern for building a repeater from scratch. The approach taken is not to give every option, alternative, or possibility for every modular piece of the repeater. Instead, a complete, workable design for a 15 watt 144 MHz repeater is described.

This article gives the necessary instructions for building, packaging, troubleshooting, and maintaining a workable 144 MHz repeater and gives a parts list with the names and addresses of suppliers. The resulting repeater will compare favorably with most commercial repeaters available on the market today.

Equipment Selection

The radio equipment selected for the repeater is listed at the end of the article (see Table 2). The VHF Engineering equipment was chosen over other units for a number of reasons. The equipment is very inexpensive and its performance equals the performance

of many commercial units. It is fully solid state and thus will have greater reliability than tube units. It is available in kit form, which means that the repeater builder will have to hand wire his own major components. By building the equipment himself, the repeater engineer will get a good feeling for the operation, adjustment, and maintenance of his equipment. Thus, after the repeater is placed in operation, the repeater engineer will be able to maintain it and keep it on the air. There is great danger in buying commercially built equipment unless you are very familiar with it. It is easy to make a repeater operational only to find that you can't keep it on the air. All of the VHF Engineering equipment operates from 12 V dc; thus, in a power failure, the repeater can be operated from a 12 V battery.

Many circuits have been published for the construction of solid state identifiers. While any of these circuits may be used, the design presented here uses a commercially available kit. Identifiers are difficult to build and difficult to debug if problems are encountered, unless of course, the repeater builder has a background in digital logic. Both time and money economies lead one to buy such a commercially available unit. This repeater uses the ID from Signal Systems. This unit was selected because of its good performance at low cost ($34.00/kit), ($39.00/wired and tested).

The antennas chosen are the ½ wave Ringo from CushCraft. These antennas are low in cost, easy to mount, and have their patterns on file with the FCC.

Coaxial cable is one item overlooked in regard to quality. The selection of poor grade cable can negate all of the gains introduced in the system by using top quality equipment. Do not skimp on cable: Use a good grade of 50 Ohm foam as recommended in Table 2.

Assembling The Kits

Even before thinking about assembling the repeater, it is first necessary to build the individual kits and make sure that they are correctly aligned. It is important to meticulously follow the instructions with each kit. Do not substitute components or attempt to make improvements in the circuits, except as indicated in this article. Make sure that the receiver, transmitter, amplifier, and COR are working correctly as independent units. Do not attempt to hook the units together until each unit operates independently. If problems are encountered, troubleshooting individual units is easier than troubleshooting the system as a whole.

Modifications

For repeater use, minor modifications should be made to the transmitter and receiver, as follows:

Transmitter (refer to instruction manual)

Connect a 100 k resistor between the cathode of D1 and the junction of R19, R20, C31 and C35. This puts a bias of 4 V on the varactor modulator and improves the audio symmetry. Connect a 1.2 k resistor to the junction of R10 and R11 to form the line input. Connect a 1 uF tantalum from the B+ connection to the ground. Place this capacitor right on the board.

Receiver (refer to instruction manual)

Connect a 10 Ohm resistor and .1 uF capacitor from pin 8 of the LM380 to ground to eliminate possible oscillation in the audio stage. Connect a 100 uF capacitor from B+ (audio board) to ground. Place this capacitor right on the board.

Packaging

This simple repeater can be packaged in a variety of ways depending on the whims and tastes of the individual builder. For sake of completeness, however, a single packaging scheme is presented in this section of the article (see Fig. 1). The repeater shown in the photographs was built according to the directions given here and is currently in use at WR2ABS .22-.82 in Binghamton, New York.

As previously mentioned, it is important to maintain complete rf isolation betweeen the transmitter and receiver in order to prevent desensitization from occurring. This is accomplished in this design by mounting the transmitter and power amplifier in a Barry Electronics #085A enclosure. (A smaller usable alternate is a BUD CU247.) The receiver is mounted in a separate 085A enclosure and the two enclosures are in turn mounted on a BUD AC-416 chassis. The

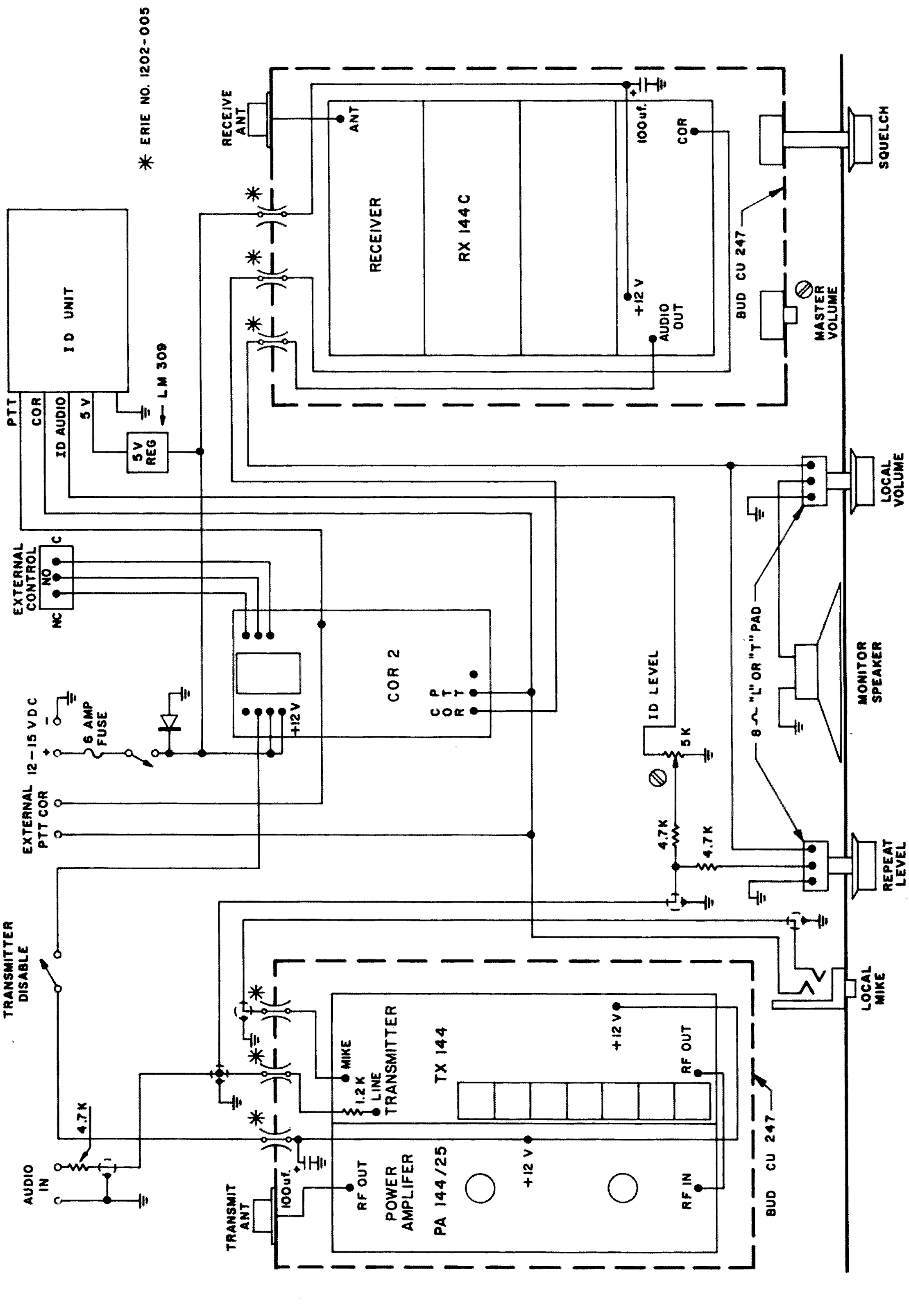


Fig. 1. Wiring System

power supply is built on this main chassis between the two enclosures, with the power supply pass transistors mounted and heat sink on the rear of the main chassis. The front panel is a standard 7" x 19" panel for rack mounting.

Follow the general layout shown in the photographs. When mounting the power transistors for the power supply, care should be taken to use a good silicone heat sink compound on all contact surfaces. Also, before mounting the rf power transistor to the case, coat both the studs and flange with a liberal amount of silicone heat sink compound. The transmitter and receiver boards are easily mounted by soldering them to a right angle brass strip fashioned from shim stock. See Fig. 2. All power leads and circuit connections from inside the enclosures are run to the outside via feed through capacitors. Erie #1202-005 feed throughs are preferred, as they provide a maximum of attenuation. If these feed throughs are not available locally, other good quality units may be substituted.

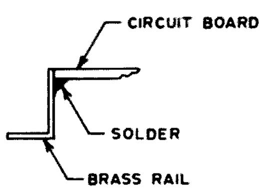


Fig. 2. Method of mounting receiver and transmitter. Brass rail is bent from brass shim stock, obtained at automotive or hobby shop.

The die cast box is adequate heat sink for the 15 watt version. If the builder uses a 25 W power amplifier, additional heat sinking should be bolted to the side of the transmitter enclosure. Be sure to use a liberal amount of silicone grease. In addition, for a 25 W version, the pass transistors for the power supply will require larger heat sinks to prevent overheating. A Thermolly #6146-2 heat sink is recommended. Three are required. For continuous repeater operation, it is advisable to run the power supply voltage at around 12 V instead of the normal 13.8 V.

The "audio in" jack is provided for use with external gadgetry such as a phone patch. Mount all units in their respective enclosures prior to testing.

Measuring RCVR Sensitivity

One of the preliminary procedures to perform before assembling the repeater is to measure the sensitivity of the receiver. By doing this at the beginning you can get a feeling of what type of performance to expect. In addition, by keeping a record of your measurements you have a reference to go by at a later time if you think that the performance of the repeater has changed.

The preferred method of measuring receiver sensitivity is the 12 dB SINAD sensitivity method.[1] This method gives accurate measurement of how easily a modulated signal can be understood in the presence of noise. Unfortunately, one of the pieces of equipment needed for this method is a distortion analyzer, a device not normally found in the ham shack. An easier but less meaningful technique is the 20 dB quieting method, described here because of its simplicity.

20 dB Quieting Method

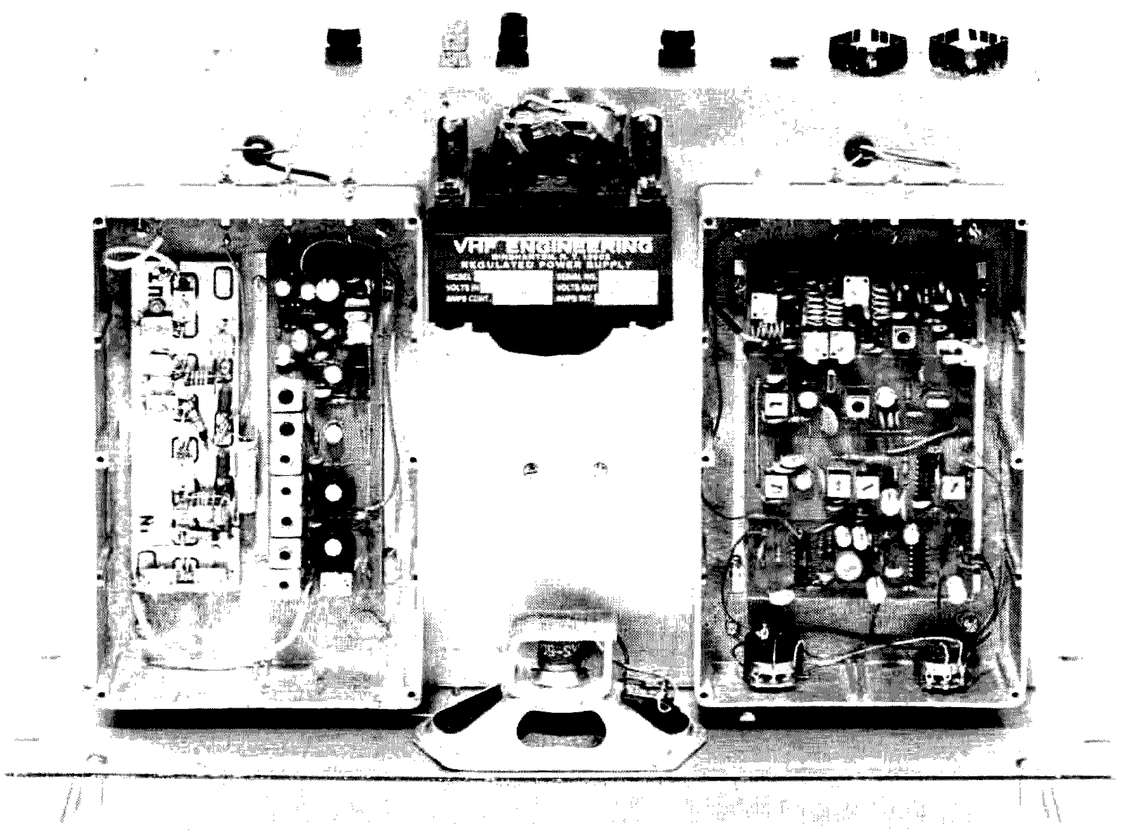
1) Connect a VTVM across the speaker terminals of the receiver. Set the VTVM on a low ac range and adjust the volume control to give 2/3 full scale reading. Note: For convenience, a VTVM with a dB scale is handy. If your VTVM has this scale, set the meter at +20 dB.

2) Connect a calibrated output signal generator to the antenna input of the receiver, set the generator to the proper frequency, and set the output to zero.

3) Increase the output of the signal generator until the meter reading is reduced by 20 dB. This is a ratio of 10:1 – if the original reading was 1 volt, the 20 dB quieting reading would be .1 V. The output reading on the signal generator in microvolts is now the 20 dB quieting sensitivity of the receiver.

Repeater Range

If you have the interest and the time you may wish to consider one of the various techniques for computing repeater range. One such method which gives fairly good approximations is described in the General Electric Data File Bulletins 10003-1, 10003-2.[2] The problem with the theoretical approach is that you can only get an



Top view of repeater showing mounting of modules. Note feed-through capacitors for all power leads.

approximate determination of the range. It is impossible to get an exact picture of the coverage area of your repeater without actual measurements, due to abnormalities in terrain, types of soil, and other factors. Most repeater builders place a transceiver at the proposed repeater location, and, using the repeater antenna temporarily mounted at the proper height, run tests with mobiles throughout the proposed coverage area.

It is poor practice to use significantly more power than is needed for the desired coverage area, since by doing this your repeater may interfere with repeaters in other areas. It is also poor practice to determine the coverage area of a repeater by putting the repeater up first and then driving around "see how it gets out." Plan first, running tests, so that you can determine if location and power are sufficient before you put the repeater on the air. By taking this approach, you have the flexibility to select another site and increase power, without worrying about possible license modifications.

Isolation Between Transmitter and Receiver

When setting up a repeater, care must be taken to avoid getting too much transmitter power into the receiver. If this occurs, the receiver will be "desensed" and will be unable to receive anything but very strong signals. In addition, care has to be taken to avoid getting spurious noise from the transmitter into the receiver. In order to prevent the transmitted signal from causing problems in the receiver, it is necessary to isolate the transmitted signal from the receiver. This can be accomplished by separating the transmit and receive antennas, by using sharp filters, by using cavities, or by a combination of techniques.

Determining The Amount of Isolation Needed

The best approach to determine the

required isolation between the transmitted signal and the receiver is that taken by General Electric Mobile Radio.[3] In their approach, they compute two isolation figures – one based on desensitization and another based on transmitter noise. They then choose the largest figure and use this as the required isolation. In our case, we don't have the required transmitter noise figures, so we will base our calculations on desensitization and assume that noise from the 15 watt amplifier is included in this figure. This approach will give reasonable accuracy.

The VHF Engineering receiver will take without desensitization 24,000 microvolts of signal removed 600 kHz away from the receive frequency. This figure was determined in the VHF Engineering labs by feeding a 1 microvolt signal into the receiver at the signal frequency and then also feeding a signal from a signal generator into the antenna through a "T." The generator was set up 600 kHz away from the receiver frequency. Desensitization did not occur with levels of 24,000 microvolts or less. The required external isolation can be determined by calculating the transmitter output power in microvolts and determining the dB relationship between the transmitter power and the tolerable level of 24,000 microvolts. In other words we must determine the isolation required so that the receiver does not see a signal from the transmitter which is greater than 24,000 microvolts. Under this condition, we will have no desensitization. Note that we are making the assumption that we will have signal strengths of 1 microvolt or better.

The required dB of isolation is computed by the formula:

$$20 \text{ Log } \frac{\text{xmtr pwr in microvolts}}{24{,}000}$$

In order to get the power in microvolts across a 50 Ohm load, use the formula:

$$V = PR$$

then multiply V by 10^6 to give the voltage in microvolts. As an example, assume a transmitter power of 15 watts. Using the formula:

$V = PR$, $V = 15X50 = 27.4V$ or $\pm .74X10^7$ microvolts.

The isolation in dB is then computed as:

$$20 \text{ Log } \frac{2.74X10^7}{2.4 \text{ X } 10^4} = 61 \text{ dB}$$

In this repeater design, cavities or front end filters are not used; instead, isolation is obtained by the antenna separations provided in Table 1.

In our example, a vertical separation of about 50 feet or a horizontal separation of about 825 feet would be needed. Note that in the case of vertical separation, the antennas must be in a straight line over each other with no horizontal separation. Horizontal separation (although inconvenient) may be used.

dB Isolation	Vertical Separation	Horizontal Separation
40	13 feet	85 feet
50	22	250
60	45	800
70	75	2350*

Table 1. (from General Electric Co., "Data File Bulletin", 10007-4, pp. 14-15)

*Figures approximate; isolations of much greater than 62 dB may be hard to achieve.[4]

When installing the antennas, use good quality coaxial antenna cable and be sure to waterproof antenna connections. Keep in mind that some leakage can occur from the coaxial cable. For this reason, it is a good idea not to tape the receive and transmit cables together as they come down the tower. Separate the cables by 6 or 12 inches.

Once the antennas are erected, the actual isolation should be measured. By doing this, you can check to see if you are getting the isolation that you predicted. If you are getting less isolation, you may have to increase the vertical spacing or use front end filters as previously mentioned. The amount of isolation can be measured as follows: Using a calibrated output signal generator, connected to the receiver, determine the signal required for 20 dB quieting. Next, connect the receive antenna to the receiver and the transmit antenna to the signal generator, and increase the output of the generator until you get a 20 dB quieting signal on the receiver. Take the two readings from the signal generator and compute the path loss by the formula 20 Log S1/S2, where S1 is the signal strength in microvolts of the generator into the antenna and S2 is the signal strength in microvolts directly into the receiver.

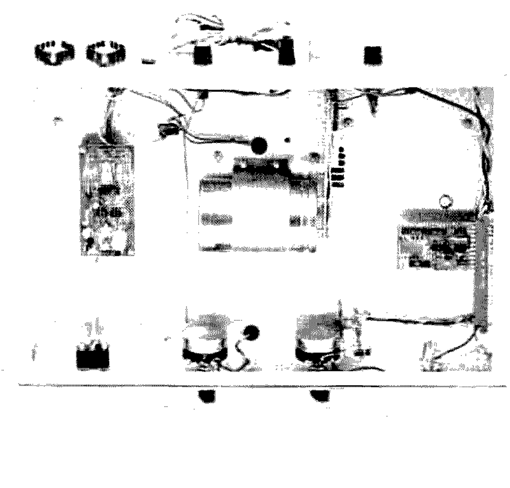
Shielding

While it is necessary to maintain the required antenna separation in order to prevent desensitization, this separation is of no value if the output from the transmitter can get into the receiver via other means. This can happen if the transmitter and receiver are mounted back to back in the same cabinet, or if the power cables are carrying the signal from the transmitter to the receiver. In order to make sure that the only signal paths in the system are the antennas, it is necessary to provide complete rf isolation for the transmitter and receiver themselves. This can be accomplished by using standard shielding practices for both the transmitter and the receiver. (See the ARRL *Handbook*).[5] The transmitter, amplifier, and receiver should be enclosed in metal boxes and the associated power and control cables should be well bypassed, as indicated in the packaging section of this article.

After the transmitter and receiver have been properly shielded and bypassed in metal boxes, a test should be made to see if the shielding is complete. Connect a meter to the first limiter (test point "A"; refer to instruction manual page on the FM-455A module) of the receiver (receiver on input frequency) with antenna terminals connected to a 50 Ohm resistor at the receiver. Place some electrical tape over the resistor and cover the connector with tightly wrapped aluminum foil. Do this to prevent any rf from getting in via the antenna jack. Connect the transmitter to a shielded dummy load. With the transmitter and receiver in their final locations in the equipment cabinet, key the transmitter and observe the first limiter current. If the current changes either down or up, then you have a problem with either the signal or transmitter noise getting in the receiver. In either case, isolation between the transmitter and receiver is not good enough. If this is the case, check the bypassing of all leads and make sure that all shields are making good electrical connections.

Final Tests

Having completed the previous steps, mount the individual enclosures on the main chassis and complete final wiring as shown in the top view photograph. Note that the identifier shown is hooked up according to the manufacturer's instructions. After hooking up the repeater, tests should be made to see if desensitization or transmitter noise is present. Connect a "T" coax connector in the receiver antenna lead, connect the antenna to one input, and connect the calibrated output signal generator to the other input. Feed a signal in for 20 dB quieting as you did when checking receiver sensitivity. (Note: If it takes more signal this time, you have noise from an outside source getting into your antenna.) Key up the transmitter and observe the first limiter reading. If the current increases, then transmitter noise is getting into the receiver. If the current goes down, then desensitization is the problem. Ideally the limiter current will not change. If the limiter current changes, the signal will become noisy. Readjust the signal generator to again give a full



Bottom view of repeater. Additional heat-sinking required on the two power transistors located top left on the 25 W model.

quieting signal. The amount of desense or noise is then 20 log S1/S2 – S1 and S2 being the two readings on the signal generator.

If either of these problems occur, it may take quite a bit of effort to effect a workable cure. One simple, but disadvantageous, cure is to reduce the transmitter power by ½ or 3 dB. Many times this will provide a temporary solution to your problems. In the case of clear cut densensitization, it is necessary to increase the effective signal isolation between transmitter and re-

ceiver. This can be done by increasing antenna spacing or by better shielding of the transmitter, amplifier, and receiver. If the previously mentioned test and checks are successfully made, desensitization should not be a problem. In regard to transmitter noise, this problem can be stubborn since the problem can be caused by a bad output transistor. The most effective way to eliminate this problem is to insert in the transmitter feed line a HI-Q cavity tuned to "suck out" at the receiver frequency.

At this point, if all problems are solved, the repeater is operational and ready for use with the exception of required means of control.

Extended Local Control

Repeater control can be done on either a local or remote basis, the only difference being the actual location of the on-off switch. Local control is by far the simpler of the two, having the advantages of both easier installation and easier licensing.

Such control can be either a switch right at the repeater or a switch on the premises away from the equipment (extended local control). Fig. 1 shows a simple enable-disable switch at the repeater. This switch disables the repeater by interrupting the current to the transmitter. For extended local control, a relay is used instead of the switch, and wires to control the relay are run to the remote location. Note that it is necessary to monitor the repeater during its period of operation. 73 Magazine and the ARRL should be consulted on current accepted and legal techniques for doing this.

Getting the License

At the present time, there is no sure fire way to get a license for a repeater in a short period of time. In addition, the application requirements are changing rapidly from day to day. Your best bet on getting your license is to write to both 73 Magazine and the ARRL and ask for all information and forms available.

Responsibilities of Operation

Before you undertake to build a repeater, you must recognize the fact that there are serious responsibilities involved with

repeater operation. For example, if the repeater is illegally used, you are responsible. In addition, once your repeater becomes operational you have a responsibility to the amateurs who are using it. You must keep it on the air, and make sure it is operating correctly and in the best interest of amateur radio. You cannot arbitrarily discontinue operation without angering the people who are using it. Just because a repeater is easy to build and put on the air does not mean that everyone should put up a repeater. For one thing, does your area really need an additional repeater, or are you building a repeater for prestige? Can you afford to operate a repeater? Can you afford the maintenance costs, etc., that a repeater will cause? Remember that it is best to line up financing before putting the repeater on the air rather than after. If you wait until after you may wind up paying for the repeater yourself. The authors recommend that a club be formed at the beginning to support the repeater. By doing this you will know how much interest you have and you will be assured of adequate financing.

Emergency Operation

One of the responsibilities of a repeater operator is to keep the repeater on the air during emergencies, especially during periods where there is a loss of ac power. With the equipment described in this article, this can be done easily by using the circuit shown in Fig. 3. A battery charger is trickle charging a 12 V wet cell battery of 60 Ah capacity or more. A relay connected to the ac line switches the power from the ac power supply to the battery when the ac power

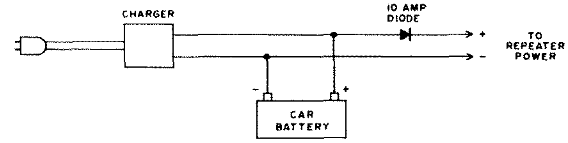


Fig. 3. Automatic emergency power, to be connected in parallel with power supply.

fails. This system provides emergency back up power and requires little care except a periodic battery water check.

Problems

If the builder follows the instructions and test procedures described in this article, few

Description	Cost	Manufacturer
Rx-144/C two meter receiver	$ 69.95	VHF Engineering
TX-144 two meter transmitter	29.95	320 Water Street
PA-144/15 15W amplifier	39.95	P.O. Box 1921
Cor-2 Carrier operated relay	19.95	Binghamton
PS-12 Power supply	69.95	New York 13902
Station Identifier (wired and tested)	39.00	Signal Systems 2537 Weston Road Colorado Springs Colorado 80910
(Above equipment purchased as VHF Engg. package.)	259.95	
(Complete rptr. kit, incl. cases and connectors, purchased as VHF Engg. package.)	364.95	
(Above complete rptr. kit, wired and tested, purchased as VHF Engg. package)	595.95	
CushCraft Ringo Antennas (2 each)	16.50	Available locally
Coaxial cable, RG8/u or T-450	.19/ft.	Hatry Electronics 500 Ledyard Street Hartford, Conn 06114

Table 2. Equipment List.

problems should be encountered. If problems are encountered, go back to the beginning, separate each component and test it individually as previously described. One problem encountered occasionally is that of intermodulation products getting into the receiver and falsely triggering the repeater. Normally this would sound like a garbled commercial service getting into the repeater. Two signals mix together producing a third frequency close to or at the repeater input frequency. Intermod is not easy to cure, let alone to find out why it is occurring. Intermod will occur infrequently on almost every repeater, such as when two mobiles from another service are very close to the repeater. If intermod occurs frequently, action must be taken. The only sure fire way to eliminate intermod which is being generated in the repeater transmitter or receiver is to eliminate off frequency signals from getting into these units. The only reliable method of doing this is to install HI-Q cavities on the receiver and transmitter, tuned to the receiver and transmitter frequencies respectively. This will take care of intermod originating at the repeater. If the intermod is occurring somewhere else and is generating a signal on your input frequency, you'll have to seek professional help.

Footnotes

1. *EIA Standard RS204, Section 3.*

2. *General Electric Co., "Data File Bulletin," 10003-2 (June 1962), 10003-1 (July 1962).*

3. *Ibid., 10007-4, Figs. 9-10.*

4. *Ibid., p. 14.*

5. *ARRL, Radio Amateurs Handbook, ARRL, Newington, Conn., 1972 and later, chapter on "Interference with other Services", 'preventing radiation from the transmitter'.*

Additional References on Repeaters:

Allen, G., W2FPP, "FM Repeater Installation", Ham Radio, June, 1973, p. 24.

Bilodeau, John J., W1GAN, "Homemade Duplexer for 2-meter Repeater", QST, July, 1972, p.22.

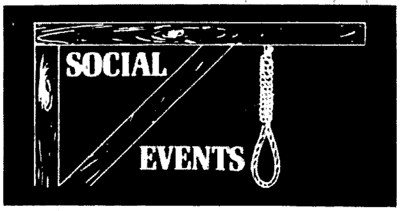
Hollar, J.S., Jr., W3JJU, "A Two-Tone Sequential Selective Calling Decoder", 73 Magazine, December, 1973, p. 8.

Olberg, S.M., W1SNN, "Two-Stage Cavity Filter for Two-Meters", Ham Radio, December, 1973, p. 23.

Singer, George, W4PPC, "Front Cover", 73 Magazine, December, 1973.

Snow, M.S., K1OXS, "A Digital Identification Unit", 73 Magazine, July, 1973, p. 39.

. . . W1HCI and W2EDN



GREENBELT, MD – FEB 3

FM Minifest at the Goddard Space Flight Center. Speaker, movie, prizes, free refreshments. Time: 1PM.

MANSFIELD, OH – FEB 7

The Intercity Radio Club annual auction will be held Friday, February 7th at the Naval Reserve Training Center at Ashland Road in Mansfield, Ohio. Doors open at 6:00 P.M. Look, swap, buy at 7:30 P.M. No flea fees nor commissions charged. Auction at 8:00 P.M. Eats. Donation of two dollars at door. For more information write K8JPF, 120 Homewood, Mansfield, Ohio 44906.

WHEATON, ILL – FEB 9

The Wheaton Community Radio Amateurs announce their 13th annual mid-winter hamfest on Sunday, February 9th at the DuPage County Fairgrounds, Wheaton, Illinois. Hours are 8 A.M. to 5 P.M. Tickets are $1.50 advance; $2.00 at the door. Free coffee and donuts 8:00 to 9:00 A.M. For information and advance tickets send a stamped self addressed envelope to L.O. Shaw, W9OKI, 433 S. Villa Ave., Villa Park, Ill. 60181.

LIVONIA, MICH – FEB 23

Michigan's largest, The Livonia Amateur Radio Club, will present its 5th Annual Swap and Shop on Sunday, February 23, 1975 from 10 till 4 PM at Stevenson High School in Livonia. 2m talk-in on 94 & 52.

LAPORTE, IN – FEB 23

The LaPorte ARC annual Hamfest-Auction will be held indoors at the Civic Auditorium 23 February 1975 beginning at 8 AM CST. First prize is $50.00 cash. Advance tickets are $1.00 each to LPARC, P.O. Box 30, LaPorte IN 46350. Advance table reservations also available $3.00 each. Talk-in on .01-.61 and .94 Simplex.

ROCK FALLS, ILL MAR 9

Sterling-Rock Falls Hamfest will be held March 9th. For info write Donald Van Sant, 1001 9th Ave., Rock Falls, Illinois 61071.

BERRIEN SPRINGS, MICH – MAR 15

Blossomland ARA Hamfest will be held at the Berrien Co. Youth Fairgrounds. Advance registration $1.50, $2.00 at the gate. Indoor tables $1.00. For info write BARA Hamfest, P.O. Box 175, St. Joseph, MI 49085.

WHITEWATER, WIS. MAR 16

The Tri-County ARC Midwinter Swapfest is March 16th, 9 AM to 5 PM at the National Guard Armory, Whitewater. $1.50 advance, $2 at the door (additional $1.50 reserves one displatable). Advance tickets eligible for special prize. Talk-in on 94. Refreshments, free parking, everything indoors. For tickets and details, Dan Servais, WA9AJW, Rt 4 Box 309AA, Elkhorn, Wis 53121. Tel 414-723-2227. SASE

CERTIFICATE OFFERED

The Massachusetts Chapter of the National Award Hunters Club is offering a beautiful Massachusetts Bi-Centennial certificate. For info on how to win it contact Robert Jennings W1DKD, 15 Cliff Ave., Scituate, Mass. 02066.

WORKED ALL STATES WEEK

The Radio Society of Greater Brooklyn will hold its first annual Worked All States Week Contest March 29 0001G to 2359G April 6. Winner will be the one to work all states in the shortest period of time. Anyone who works all states within the period will receive a certificate. Special certificate to the Novice who works the most states and operator working most states under most unusual conditions. Number of states only counts, not number of QSOs. Logs must include description of your station and the time, date, call and state of all stations worked. Any legal band, mode or power. Send logs to F. Grossman WB2BXO, 9519 Ave. M, Brooklyn, NY 11236.

18th ANNUAL QCWA QSO PARTY

Starts: 2400Z Friday February 7, 1975

Ends: 2400Z Sunday February 9, 1975

Activity will be within about 5 kHz from the following frequencies:

CW – 3550, 7050, 14050, 21050 & 28050.

SSB/AM – 3900, 7240, 14270, 14340, 21390, 21435 & 28600.

RTTY – 3595, 7095, 14095, 21070, 28070.

FM – 146.55 Simplex and don't overlook the repeaters.

The theme this year is Accent on the Chapters. Scoring will be computed by using the number of contacts times the number of chapters contacted times the number of QCWA Directors worked. With 69 chapters (at this writing) plus ten QCWA Directors, the scores are going to be high. Members not associated with a chapter will use "AT LARGE" instead of a chapter name. We are proud of members that belong to more than one chapter but for this contest they will please use one and only one chapter name. Each QCWAer submitting a log will provide a summary sheet with the total number of contacts, total number of multipliers and score. Repeat contacts on other bands or modes do not count for additional score.

The Houston Chapter of the Quarter Century Wireless Association is sponsoring the contest this year. The Contest Committee appointed by President Lindsey W5FR is:

Monty Montemayor W5YZ Chmn, Otho Lindsey W5FR, Jerry Sears W5AIR, C.B. Scott W5GPD, Lee Ruetz WA5RDO and Wayne Stenback W5MDV.

Your logs should be sent to W5YZ, QCWA Houston Chapter, Post Office Box 55254, Houston, Texas 77055 by March 10, 1975. See the December QCWA NEWS for further details and information.

Ham Help

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

James H. Genzling
512 N. Alice
Monahans TX 79756

Philip Smith
2841 E. Sherran Lane
Phoenix AZ 85016
602 956 0954

Norbert Adsit
29025 Yorkshire
Warren MI 48093

Bill Vokac K9WQY
Box 216
Mansfield IL 61854

The Heath SB-103?

. . . Not Quite

Well. . .the "hams at Heath" have done it again! Just as I've almost completed my set of matching Heath SB gear – out comes an entirely new line (SB-104 & accessories) that puts whiskers on my SB-102 and its matching equipment.

Being a resourceful ham (translation: short of funds. . .)I figured I could update my SB-102 by adding those state-of-the-art features which obsoleted it. All I did was to compare the two rigs and make the necessary changes. What follows is a description of this conversion, which should also work on the KWM-2!

A comparison of the specifications and features of the SB-102 versus the SB-104 indicated the following features needed to be added to my SB-102:

1) solid-state circuitry
2) digital readout
3) broadbanded receiver & transmitter
4) QRP output
5) call sign light

The first two features seemed rather difficult, so I decided to work on my list from the bottom up. . .to build confidence. This technique is highly recommended as it led to the ultimate completion of all five features of the conversion!

#5 Call-sign Light

First, I selected a clear strip of Dymo label-maker tape and press-typed my call, K9WQY. Then I peeled off the self-adhesive backing and applied it in the middle of the lighted dial. I was careful to put it in the exact middle of the dial for maximum visibility during contest operation (I always seem to forget my call in the middle of a contest. . .and who cares what frequency I'm on in the heat of a contest anyway?) Having accomplished the first conversion with remarkable ease, I plunged upward through the list.

#4 QRP Output

Actually, the SB-102 was capable of QRP operation all the time. I discovered the QRP output jack on the back of the SB-102 was mis-labeled, "Driver output," Of course, then I had to use my secondary receiver and antenna to hear any replies. I considered installing a TR switch or antenna relay and using the receiver antenna jack on the rear panel of the SB-102, but I wanted to avoid any major changes in the rig to keep re-sale value high.

As it turned out, I found an even better way to QRP operation. Read on. . .

#3 Broadbanded Receiver & Transmitter

SB-102 owners have always been plagued by the "bothersome Preselector, Load, and Tune controls." (Heath catalog) The "hams at Heath" have eliminated this "problem".

This was a "toughie" until I realized. . . no controls = no tuning = broadbanded!

Once over this hump in logic, I began the conversion to broadbanded operation in earnest. First, I removed the following control knobs from the front panel:

1) driver tune
2) final tune
3) final load

The tuning shafts now protruded from the front panel and seemed to defy me. I

decided to hack saw them off flush with the front panel bushings for a neater appearance. To complete the job, I got some matching green-flake paint (from Heath) and covered both the front panel bushings and the end of each shaft. I made a mental note to do "something" about the panel lettering, too . . .at a later date.

I achieved a couple of unexpected benefits from this step in the conversion process, namely:

1) I no longer needed to use the "driver output" jack for QRP operation, and. . .

2) my receiver sensitivity now exceeds the reduced sensitivity of the SB-104 (<1.0 uV versus < .35 uV for 10 dB S +N/N for the SB-102). In fact, sometimes I can't even tell if the band is open.

The "SB-103." Notice the critical placement of call sign in full view of operator, and "clean look" of front panel with tuning controls eliminated.

#2 Digital Readout

Heath has had a digital frequency display, the SB-650, available for the SB-102 at a good price for some time now. A good price, that is, unless you're a "resourceful ham" like myself.

First, I constructed a power supply for 8 Nixie readout tubes (I wanted one cycle resolution. . .I *never* do things halfway!). Next, I connected 8 decade switches so that I could turn on any digit in any place at will. Thus, I can "dial up" any frequency I want down to that one cycle resolution. How's that for accuracy! This really works great sitting atop the SB-102 and really impresses non-ham visitors to the shack. However, the transceiver frequency doesn't seem to follow the Nixie tube readout at all. I plan to work that out sometime.

#1 Solid-state

The first step toward solid-state was to partially integrate the circuits by bussing the fuses. Complete integration would require bussing the wires as well. At this point, however, I realized that the biggest disadvantage to my tubes in the SB-102 was the large amount of energy that was wasted in the heating of the filaments. So. . .I added a switch in my HP-23B power supply so that when I want to conserve power I just switch off the filaments. Simple, eh?

However, a couple of disadvantages to this scheme were noticed immediately:

1) the dial lights usually go out and I can't see my lighted call sign any more. . . which means I'll probably go on forgetting my call during contests, and. . .

2) signals tended to fade out rather quickly on receive, but this deficiency was offset by the transmitter becoming *truly* QRPp.

Having completed the conversion, a new model designation seemed in order. After all, my rig was no longer a "mere" SB-102. Not having all of the features of an SB-104, the "skipped over" SB-103 designation seemed to fit. Let's see, where did I put my label-maker. . .?

All is not right, however. The rig has been in use for several hours and some undesirable characteristics have appeared:

1) the "SB-103" does not work well on transmit or receive with the filaments turned off.

2) with the filaments on, I can operate high power only on 7302 kHz (which is where I was operating before the conversion).

3) no replies to my numerous transmissions have been heard as yet.

4) the green flake paint *is* flaking off.

Does anybody know how to work on an SB-103?

. . .K9WQY

E.H. Sommerfield W2FJT
49 Spring Road
Poughkeepsie NY 12601

Get Into a Grey Mood - Generate

Modification of the ROBOT Research Inc. Model 80-A SSTV Camera for Grey Scale Generation

A grey scale generator generates frequencies ascending, or descending, between 1500Hz (black) to 2300Hz (white). This spectrum enables the SSTV receiving operator to adjust his/her display brightness and contrast controls for a linear white to black display.

Sophisticated digital timing chains driving digital-to-analog converters, which in turn, drive a VCO (Voltage Controlled Oscillator) through 4 to 16 discrete frequencies (levels of brightness) can be found in the SSTV Handbook published by 73 Magazine. This article describes an alternative method that generates linear, rather than discrete, levels of brightness. Although a linear display may not be considered sophisticated enough for the idealist, I have found a linear display sufficient for the application; and the $3.75 price tag can't be beat!

Design Considerations

The only constraint placed upon the design was that no modifications be made to the 80-A circuit board. This was done mainly to insure that the board could always be returned to ROBOT on an exchange basis, for an improved one necessitated by engineering changes.

The design is based upon the statement made by ROBOT on page 8, paragraph 3 of their instruction manual. "Maximum video excursion is limited such that whites do not produce frequencies above 2300Hz nor blacks below 1500Hz." This is accomplished electrically by the clamping action of the collector to base diode action of Q4 and Q5.

The design described in this article is based upon the fact that if the video excursion can be forced, safely, between these limits, then a 1500Hz to 2300Hz, grey scale will be generated.

A forcing signal can only be applied externally to the clamped video line safely at pin "S." If the signal is applied at either pins "R" or "K," there is the chance that it will be applied directly to the output of U12, if S2 is in the reverse position, and damage U12. Depending on the normal bias levels at the emitter of Q3 (set by the brightness control) it will require about ±0.3mA to drive the video line to the clamped limits. This value could be as high as +3.3mA at the lowest brightness extreme, but this is not the normal operational range. The forcing signal is not applied during non-grey scale operation, so as not to deteriorate the existing video levels.

Circuit Description of Modification

The schematic is shown in Fig. 1. The horizontal deflection voltage, a sawtooth signal, approximately ±3V centered about ground, is applied to an emitter follower via a variable signal attenuation network mr1, mr2. This signal is applied, via msw1-A, to the clamped video line when msw1 is turned to the "SCALE" position. When msw1 is in this position, the contrast voltage is reduced to near zero by mr6. mr6 limits the discharge current to 20mA maximum when msw1 is turned to "SCALE." A separate "Brightness" voltage, determined by mr7, mr8, is applied to the video clamp line via MSW1-C and pin "V." It is, therefore, possible to set both the bias level via mr8,

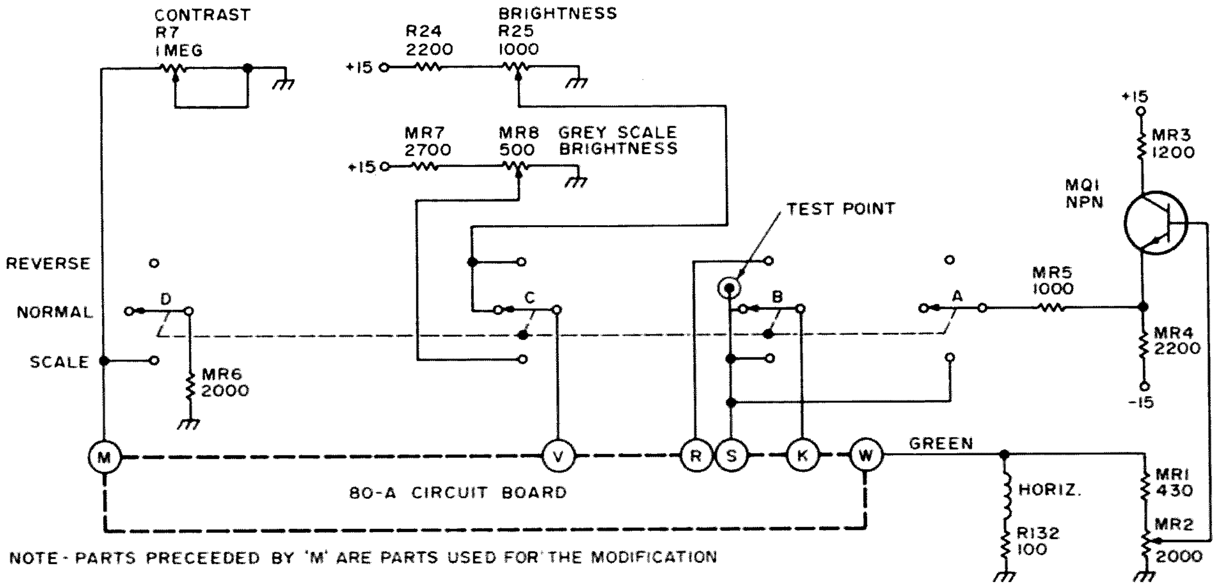


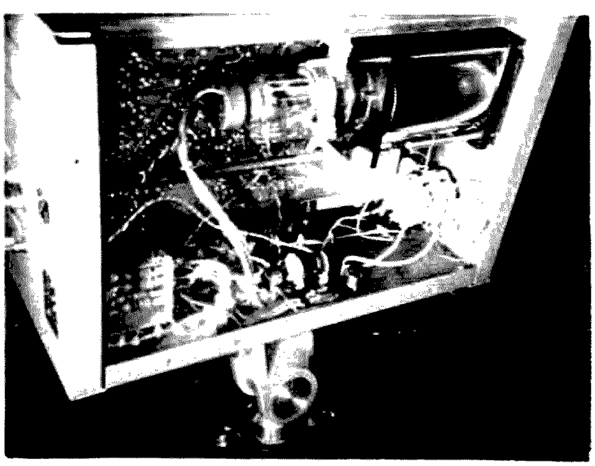
Fig. 1. Modifications to the Robot Research SSTV camera Model 80-A to provide "Grey Scale" generation.

and signal level via mr2, to force the clamped video line to both + and - clamped levels in the absence of any vidicon signals (mr6). Since this is done via the horizontal drive signal, a line is displayed starting with white, -.6 clamp voltage, and ending with black, +.6 clamp voltage. The settings of the "SCALE" signals do not affect normal brightness and contrast settings.

Physical Modifications

S2 was replaced by a 4-pole 3-position rotary switch. All components except mr6 were placed upon a 5.08cm x 5.08cm (2" x 2") vector board and mounted, via a .95cm (3/8") spacer and a 2.54cm (1") 6/32 bolt inserted through one of the holes of the tripod mount base plate.

+15V is located on one of the solder terminal strips, and -15V is located on pin 6 of the power plug.



Looking at the photograph, the two trimmer pots are located in the center of the board and the transistor is located in the lower right corner of the board. Notice the new 4-pole rotary switch at the right side of the photo.

Adjustment

With an oscilloscope at test point "T" (Fig. 1) on the clamped video line, adjust mr2 and mr8 for maximum signal such that the positive and negative peaks just begin to show signs of clipping.

Conclusion

The linear circuit is far less expensive, and much easier to implement and adjust than the discrete circuit.

I have adjusted Slow Scan displays using both discrete step and the linear signals with little difference in the end result.

Parts List

mq1 – General purpose NPN silicon 12V transistor "CALECTRO K4-506" ½ watt. Lafayette.
mr1 – 430Ω 1/2 W 10%
mr2 – 2000Ω 1/10 W 100 V Linear Sub-Min Trimmer CALECTRO B1-643. Lafayette.
mr3 – 1200Ω 1/2 W 10%
mr4 – 2200Ω 1/2 W 10%
mr5 – 1000Ω 1/2 W 10%
mr6 – 2000Ω 1/2 W 10%
mr7 – 2700Ω 1/2W 10%
mr8 – 500Ω 1/10 W 100 V Linear Sub-Min Trimmer CALECTRO B1-642. Lafayette.
msw-1 – 4 pole 3 Position Non-shorting Rotary Switch.

. . . W2FJT

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Instant Neutralization

The following, while intended to apply specifically to a Heath SB-110A, would be equally applicable to other gear containing similar circuitry. The SB-110A final and driver neutralization is a rather long and involved process not so much due to the electronics, but rather to the fact that the screen voltage is removed from the stages to be neutralized by alternately removing two resistors from feedthrough capacitor "AU." The time and effort involved may be reduced to a fraction of normal if a switch is installed under the chassis. This switch connects either or both of the before-mentioned leads to the feedthrough and allows instant changeover during neutralization.

The switch is mounted in the "driver shield," immediately below the driver tuning capacitor, with the shaft/knob in line with the shaft of the "mode" switch. The resistor leads involved will reach this point without difficulty and only a very short length of wire is needed from the switch common to the feedthrough.

There are two types of switches which will work in this modification, the most common being a "rear seat speaker switch" of the front-back-both variety. A double pole, three position switch will do as well, but it is a little more expensive.

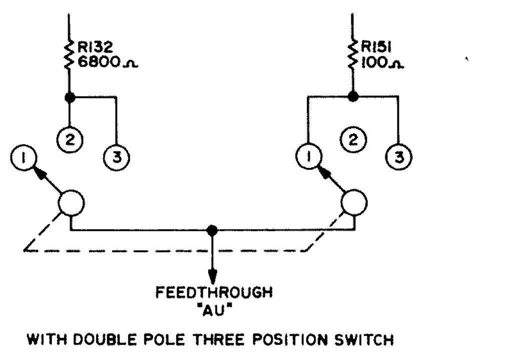

Fig. 1. Feedthrough "AU" with double pole three position switch.

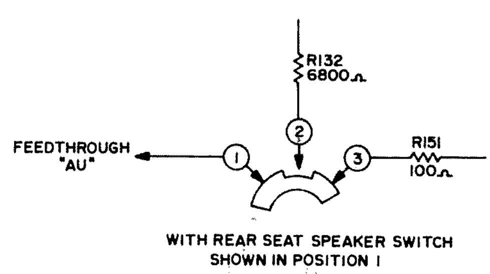

Fig. 2. Feedthrough "AU" with rear seat speaker switch shown in position 1.

In the examples, position 1 removes screen voltage from the driver allowing neutralization of that stage. Position two reconnects the driver and removes the final screen voltage for similar purposes. Position three restores the connections and the rig to normal operation.

. . . **WA0ABI**

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Phoenix Hams Show How It's Done

Ham radio was on the spot before the eyes of the world out in Arizona in mid-September, and twenty five Scottsdale area hams from five clubs in the Valley of the Sun opened up the eyes of the world to the possibility of using radio to link together the six hundred members of Sister Cities International in sixty five foreign countries and the U.S.A. They did it in spite of considerable adversity.

Sister Cities International has been called a "good will people-to-people program" whose aim is to make life better by promoting international peace and understanding through having cities in different parts of the world pair off and work together on each other's problems.

Hams from the Scottsdale, Phoenix, and Arizona Radio Clubs joined those from the Arizona Repeater Assn. and Bash-Hal-Ne-Ae and accepted a challenge from Sister Cities to rig up a temporary demonstration station at famed Mountain Shadows Resort for nearly five hundred convention delegates. The event was the sixteenth annual international convention, meeting under the banner of "Communicating for World Peace."

The whole thing got started on Wednesday, September 18, when the five hundred delegates blew into Paradise Valley, just north of Phoenix. Were it not for the sturdy and sumptuous quarters in which they were lodged, they would have been blown right back out again by the niftiest patchwork of intermittent storms to flash through the area in many months. Strong winds drove delegates indoors, while sheets of rain whipped under the covered walkways and jagged lightning walked around the mountain tops.

One puffing delegate from the Midwest said, "My gosh, this is the arid Southwest? Every time I poke my head out of the meeting room, I see ugly clouds, rain and lightning."

For the hams, things began several days earlier when they wheeled into the hotel parking lot with a pickup truck laden with personal and borrowed gear. Ex-Navy airplane jockey Tom Moore, W7FCQ, was ram-rodding, having taken over from Bill Eccles K7MJC, who had planned the ham end of the project some six months before. It was Tom's job to set up the equipment and erect two antennas on the roof of Flirtation Walk, leading in from the resort's tennis court and golf course. He had earlier gotten permission from the FCC to operate with the mysterious call, WH7SCI.

Given his choice of station locations, Tom had the gear set up right outside the door of the elegant Navajo Room, where the delegates would confer. The spot was on the hotel end of Flirtation Walk, under the roof, but protected on the back and sides only by shrubs and a fence. Under normal Arizona conditions, the site would have been superb, but nobody figured on the rain.

"We knew about the bad weather conditions coming," Tom said, "and we figured that wind would be our biggest problem, so

Sometimes everybody forgets the same thing – in this case an identification sign – so Gene Hubbel W7DI whomped one out on the spot and hung it up for the 500 delegates of the 16th International Convention of Sister Cities to see.

we prepared for that. But it was the rain that nearly got us."

To handle the wind, Tom used new 2000-pound-test nylon ropes on the old style three-element Mosley Jr. beam that the antenna crew hoisted up onto the roof. A Bassett trap inverted V was strung up for 75 and 40 meters, and a portable Hy-Gain Yagi beam was put up under the roof for the little 2-meter rig. All three antennas weathered the coming storm with no trouble.

Jean Murphy, head of the hotel catering service, provided two heavy tables for the rigs. Then she won over all of the hams by covering the tables with linen tablecloths before the rigs were put in place.

"The XYL ought to get a load of this!" said one ham who apparently was having a little trouble at home.

The hams hooked up a Collins 75S-3C, a 32S-3, and a 30S-1 amplifier, all borrowed from Barry Goldwater, and the Scottsdale Radio Club brought a Drake TR4 transceiver. Gene Hubbel W7DI provided a Swan Signet transceiver, and others brought keys, mikes, connectors, and handy lengths of co-axial cable. Everything was carefully and properly hooked up by Tuesday evening, Sept. 17, and with a bevy of curious onlookers gathered around, the big switch was thrown. Nothing happened – at least not in the big rig. Voltages were down 50 per cent and the time delay in the plate circuit wouldn't even come on in the 30S-1.

With several hundred years of combined experience in radio on the spot, no problem remained a mystery for long.

"We just hadn't talked the same language as the hotel engineer," said Tom Moore later. "We had asked for 220 volts, and he gave us just that – with one side grounded. We hadn't told him we had a splitter in the transmitter."

Once the trouble was known, Dean Mendel, the hotel engineer, gave the hams 220 with a common from a box on the lawn, and WH7SCI was on the air testing as K7MJC/7, until their allotted time began on Wednesday. Running barefoot to the east coast, they got a 20 over 9 report from Tom Azzara W2LFB in Nutley, N.J.

But troubles never come singly, and the station was just beginning to get a rhythm to its calls when something happened to the power. It was being drained off as though in a science fiction movie. This problem, too, was quickly located, but it was not solved. Somebody noticed that the hotel swimming pool area was fiercely aglow with lights. A local Cadillac company had rolled in a whole convoy of new cars and spotted them around the swimming pool and on every available flat spot on the lawn for the viewing of a throng of guests that number in the thousands. Each vehicle was brilliantly spotlighted so that gowned ladies and their smartly dressed escorts could view plush interiors and peek under hoods without spilling their martinis.

At 5:40 p.m., somebody decided that WH7SCI was still drawing too much power, and they pulled the plug on the station completely. Nobody minded too much since the convention hadn't yet begun, and forecasters were beginning to say nasty things about the evening weather. On their way home, the hams went past the auto show and bumped into a worried Jean Murphy, the thoughtful cateress.

"I just told the head Cadillac man that it was going to rain and ruin his whole show," she said, looking up at the sky, "and he told me, 'Don't worry, God drives a Cadillac, and He won't let it rain on these.' "

And He didn't.

Back on the air at 5:00 a.m. Wednesday,

the hams found conditions spotty, just as amateur radio publications had predicted they would be. The day had dawned cloudy, and action on the rigs and around the station didn't get heavy until nearly noon, after the delegates to the convention had registered and read the hundreds of brochures about various cities that were spread out on a thirty-foot table in the hotel lobby.

The hotel had suddenly taken on a "poster night" atmosphere like in professional hockey. "See you in Surprising San Jose" in orange day-glo jumped at you from the glass door leading to the pool, and beside it was a varicolored sign inviting you to "Rochester, the Picture City." Posters for other cities clung to the outer walls leading to the convention room.

Foothill College of Los Altos Hills, California, had prepared a fine booklet on ham radio for the convention. Entitled, "Sister Cities and Amateur Radio," the booklet covered everything from "What is Amateur Radio?" to "How to Get Your Own Amateur Station," to "A Sister City-Amateur Radio Network." Thanks to the ARRL, the booklet was illustrated with a great variety of pictures of ham operators all over the world and told of the function and value of the Medical Amateur Radio Countil and other radio and emergency networks. The booklet was given to all delegates to the convention, and since Wednesday was a light day in their schedule, many delegates must have read it.

A steady stream of people from all over the world began showing up to watch WH7SCI being operated. As a rule, they hung back and tried to figure the thing out by themselves. Fortunately, there were enough hams on hand to do a little public relations work, and they introduced themselves and told in simple terms how ham radio functioned. Almost all of the delegates, regardless of what point of the globe they hailed from, could speak English, and some of them came back several times, each time adding to their understanding of amateur radio.

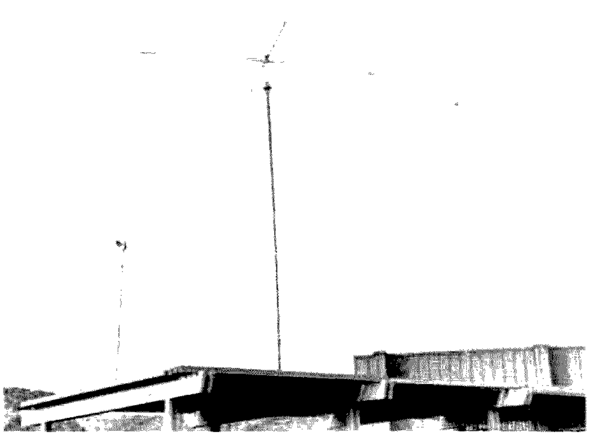
A delegate from Cavite in the Phillipines asked Gene Hubbel W7DI if he could put him in touch with his government. But propagation was so poor out of state that Gene had to tell him the job could be done, but it would take a little time.

The station operators had hoped to try some delegate-to-home hookups, but conditions remained so spotty that they hated to build up any delegate's hopes.

About noon, massive clouds that had been hanging around the Valley lumbered in ominously for a convention of their own. As though on signal, lightning began leaping among the clouds and striking out for the higher mountains. Thunder ripped through the Valley, and the sky opened up right over the hotel and its radio station. And then the wind came up, driving every single delegate indoors, and leaving nobody but the determined hams out in the slanting rain.

Bob Johnson W7JTL was on the air when the storm hit, and Tom Moore and Gene Hubbel were talking to delegates. Bob hunched over the radio gear, which was safely back against the wall of the hotel, and Tom and Gene watched in disbelief as the rain poured off the roof.

"What worried us most," said Tom, "was a downspout that somebody had bore-sighted right straight at the lawn box from which we were drawing our power. Water gushed all over that box, and why it didn't blow a circuit breaker, I'll never know."



Tom Moore W7FCQ and his antenna crew drilled a mast hole in a 2 x 4 nailed to a half sheet of plywood, laid it down for the butt end of the mast, and hoisted the Mosley tri-bander into position on the roof of famed Mountain Shadows' Flirtation Walk. Cinched to the cross members of the roof with heavy nylon ropes, the beam easily weathered high winds and torrential rains.

Gary Chinn WA6WDC hunts for action on Gene Hubbel's Swan Signet while Bob Johnson W7JTL works the "big rig" borrowed from Barry Goldwater. Hams fought poor propagation and still managed 690 contacts in U.S. and 40 DX during three-day Sister Cities Convention. They missed WAS by one state – Delaware.

To make matters worse, the torrent grew in volume until the drainage system couldn't handle it. Water covered half of the concrete walk, reaching to the chairs on which the operators sat, and it flowed over the lawn and deepened until it was licking at the power box. As long as the engineer left the power on and conditions on the walk were safe, the hams were determined to keep the station on the air.

Gradually the rain stopped, and the water whisked away to lower ground. Curious delegates tip-toed around the puddles on the walk, anxious to get back to see if the hams were still there. They were, as eager and smiling as before. The antennas and all the other gear had come through the storm unscathed, and the operators had been given one more good story to tell.

When the bands fell apart at 9:14 p.m. Phoenix time, Gene Trabor W7GX had written the 208th contact into the log on 20 meters.

Phoenix mayor Tim Barrow delivered the official welcome to the Sister Cities delegates at a mid-morning session on Thursday, and set the theme for the duration of the convention when he said, "The key to resolving problems, be they local or international, is contact – communication – between and among individual human beings." Other speakers tied this idea in with amateur radio, calling attention to its accomplishments and inviting the delegates to visit WH7SCI. As a result, the band of diligent hams out on the sidewalk had a lot of company throughout the remainder of the convention.

The delegates were bussed out to the Western Town of Rawhide north of Scottsdale Thursday evening, and while they were savoring thick, delicious slabs of beef, the

hams continued to fight wind, rain, and poor propagation. A new problem developed when a couple of avid brass pounders decided to go on CW to beat the poor conditions. The big rig borrowed from Barry Goldwater wouldn't key, and it was discovered that somebody had made internal changes that made it function only on voice. Rather than stop communications to work on the transmitter, the operators decided to forego CW.

Gene Hubbel and Rick Olsen WA7CNP tried the little Swan rig on CW but discontinued it when the operators using the mike at their elbow reported annoying key thumps on their receiver.

"Next time we won't hook the inverted-V onto the mast with the tri-band beam," Tom Moore said. "The antennas were just too close together."

But the brass pounders hung in there, picking off a few moments on CW whenever they could, and by the end of the convention, they had rung up a modest score of forty contacts.

Propagation, which had been spotty all day, continued that way through the evening, with conditions varying from impossible to an "everything goes" situation when the operators could make solid contact no matter in which direction they swung the beam. When the bands closed for good Thursday night, WH7SCI had scratched up another 152 contracts to make a total of 360.

Early rising delegates and hams wrinkled their brows Friday morning when they walked out around the hotel pool and cast their wary eyes upon the sky. The clouds were still there, promising rain again, and later delivering it. But it wasn't the rain that disappointed them most — it was the failure of that leaden sky to deliver a featured speaker of the convention, Senator Barry Goldwater K7UGA.

Unfortunately for the convention — and for the hams who had hoped to get the senator behind the mike for a while — Barry had been called into special conference by President Ford, thus delaying his departure for Phoenix. He did arrive in time to tell 900 Southwest District Kiwanians why he thinks we should go back on the gold standard, but he missed the Sister Cities Convention altogether.

Arizona Supreme Court Chief Justice Jack D.H. Hayes filled Barry's place on the program. Justice Hayes adjured the delegates to do what amateur radio operators often call out for their club members to do — involve youth in the effort to keep lines of communication open.

"Boy, you really brought 'em out of the woodwork!" kidded his partner. Then the single word "Smile" came clearly over the air. . .

"I am convinced that involvement with youth is the only way to attain lasting goals in international relations," Justice Hayes emphasized.

Youth activities were underscored with the awarding of U.S. Savings Bonds and certificates to essay contest winners across the country. The top award went to Andrew T. Oram, 16, of Jamestown, N.Y., who wrote on the theme of "How Our Community Can Celebrate America's Bicentennial Together With Our Sister City."

Meanwhile, out on the sidewalk, the hams on the mike were sending a lot of energy out into the universe, but getting very little in return. At one point, Len Ford W7AE thought he might really break 'em loose with a CQ, so he banged one out and waited. . . and waited. . .

"Boy, you really brought 'em out of the woodwork!" kidded his partner, Dave Cave WA7PBM.

Then the single word "Smile" came clearly over the air. It was a local ham who had been reading the mail and couldn't resist making the ironic rejoinder. He identified himself and later showed up to take his turn on the mike. As you might guess, his short communication brightened everything up — even the frequency — and soon the hams were popping off QSO's like they could on field day a few years back. But it didn't last. When 40 meters fell apart and the station closed at 8:34 p.m. Friday, the hams had managed a total of 91 contacts.

Saturday turned out to be the big day for both the convention delegates and WH7SCI. Delegates were kept busy all day with the annual business meeting, area studies workshops, a Town Affiliation Assn. directors meeting, and a conference reception. But the big event was the annual banquet with presentation of awards by the Reader's Digest Foundation, the sponsoring organization.

Spokane, Washington and Nishinomiya, Japan, got an award for planning and building a Japanese garden in Spokane. Portsmouth, Ohio, and Orizaba, Mexico, got an award for greater awareness and respect for each other's people. Glendale, Arizona and Delicias, Mexico, were given an award for planning, building, and learning to operate a fire truck. Glendale built it and delivered it to Delicias, and then trained the Mexican firemen to operate it. Numerous other awards were given by Kent Rhodes, president of the Reader's Digest Foundation, for such things as dramatic help, cultural exchange, and youth programs.

WH7SCI operators found propagation better than on any of the three previous days, making 279 contacts and running their convention total to 730. Most of the operators had rain paths across the shoulders of their jackets, but there was no major downpour.

A delegate from Mexico came by repeatedly to check on conditions in Honduras, where Hurricane Fifi had killed 7000 people. Late in the day, he went away relieved when the hams could tell him that the worst was over and cleanup operations had already begun. His thanks and look of relief told that he had become a believer in ham radio.

"Amateur radio is an obvious communications factor, frequently ignored until the Phoenix conference"...

The most emphatic convert to the value of ham radio may well have been Dr. Joao Goncalves de Souza, from Brazil. Dr. Goncalves came to the station and asked Rick Olsen if he would call his home town in Brazil. (After all, hadn't the official conference program stated right on top: "The Ham Center will permit conference delegates to call their Sister Cities through amateur radio operated by experts familiar with international telecommunications systems." Why not a call to one's own city?)

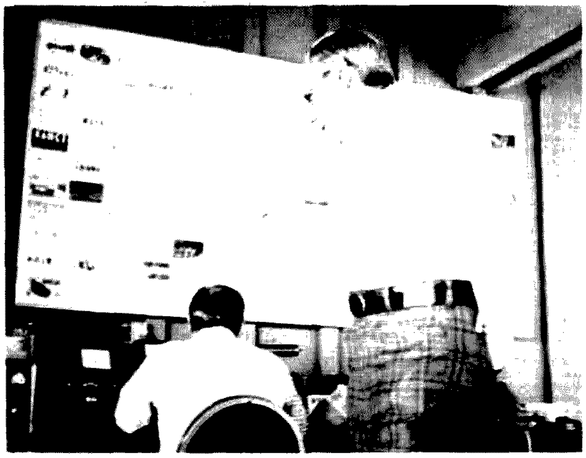
Rick swung the beam and banged out a CQ. Back came a Brazilian freighter off the coast of South America, PY2BHL/portable mobile marine. The doctor talked for five minutes with the freighter's OM in his native tongue, Portuguese, he would have been very satisfied with that, but when Rick signed with the freighter, on came PY4AKZ in Brazil, forty miles from the doctor's home town. In short order, PY4AKZ clued him in on everything he wanted to know about home. Ham radio had found another believer and friend.

By the time the last Sister Cities awards were being given out, the bands were getting ragged. The end came when Ed Marple WA7KFA and Rick Olsen worked W6LUV/KV6, Frank, on Canton Island and moments later couldn't get out of town. And that's where the whole thing ended, with Jack, W7JDW, just a few miles away.

"Take her down," said Tom Moore, and fifteen minutes later all the gear except the antennas was in the back of the truck. WH7SCI had sent its mysterious call out for the last time, and hams like Al Schmidt, K9DIN, who typified hundreds of other hams would wonder no more. Al, up in Two Rivers, Wisconsin, had figured out that SCI stood for Sisters Cities International, but he had to admit, "That H in there is a new one on me." Actually, Tom Moore had asked for the H because he wanted it to do what it did – attract attention.

Doris Counts, club secretary for Bash-Hal-Ne-Ae, picked up the log books so she could send out QSL cards, and the show was over.

But the weather had the last word. The antenna crew was scheduled to have a take-down party at 10:30 a.m. Sunday, with the 73 MAGAZINE photographer on hand, but lightning had again begun its spectacular march toward Mountain Shadows Resort.



A somewhat puzzled delegate looks over operators' shoulders at WH7SCI and Tom Moore's QSL card bulletin board. Tom framed a sheet of celotex, pinned the cards up, and found that delegates were impressed by the great number of different contacts a ham station can make.

When the photograph arrived, the party was over.

"We weren't about to play games with that lightning," said Tom Moore.

All that remained was for Richard H. Oakland, Associate Director of Sister Cities International, the chief engineer of the convention, to give his appraisal.

Oakland said that the convention had achieved its three main goals: developing stronger ties between international organizations with Sister Cities objectives; finding new ways of communicating with cities throughout the world; and involving more American cities in international programs of America's Bicentennial.

"Amateur radio is an obvious communications factor, frequently ignored until the Phoenix conference," Oakland said.

In his final statement for 73 Magazine, Oakland said, "The amateur radio center operated during the Phoenix conference was highly successful. It started a lot of delegates thinking about amateur radio. The 'Center' will become a permanent fixture at our annual meetings and – as the years go by – will become much more sophisticated."

The hams can take it from there, thanks to Tom Moore and his band of twenty-five volunteers – and the guy who loaned them that heavy equipment.

... K7NZA

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Oh, The Lost Art of Diplomacy

The following is not fiction, but for the sake of all parties involved the call signs have been omitted and the names changed. I personally witnessed the events and checked out the authenticity of the facts, statements, and circumstances which took place.

I had contacted Randy many times prior to the events.

Some years ago, Randy was told by his physicians that he could no longer fulfill his duties in the International Division of a large corporation for which he had served for well over thirty years. He knew it would be quite a blow to suddenly retire from a life that had taken him to 35 different countries throughout the world.

He was a well-thought-of junior executive (back when the dollar was one hundred cents), but his spinal disability had deteriorated beyond hope and Randy was in constant pain. Then he developed angina pectoris that could only add to his misery.

Of course retire he did, and in the first year of retirement he suffered not only physical misery but mental anguish. Randy thought if he were to remain sane he must find something to occupy his active mind. He had come up through the ranks of his company – first a technician, then a sales engineer (methods and systems), then branch manager, and finally export manager at the Washington, D.C. branch. The firm manufactures electronic office equipment; therefore he was bent many years ago toward electronics. Having been a technician and systems sales engineer, Randy had always wanted to be a ham, but now he was almost 60 and wondered if it was too late. However he decided he might be able to make it – even though he was living in his twilight years. Randy remembers that one of the first courses he took before going into sales was the Dale Carnegie course in "How to Win Friends and Influence People." Thereafter all his training dealt with human behavioral patterns. So, therefore, his friends encouraged him to try amateur radio, even though he had to go through the Novice experience at around age 60, mostly with young people. He liked young people and could bury his pride to accomplish his goal.

Randy bought a radio telegraph key and put together a code oscillator, while spending most of his time in bed – for one month he practiced code while in much pain. In addition to this, and with the help he received from the local radio club, he took the test and received his Novice license. The club straightened him out on proper timing of his self-taught code. He said it was like learning code all over again.

He then set about putting together a rig bought as a kit (Heath DX60 and HR10). He could work only twenty minutes at a time because of his affliction. He states he learned more trying to make the rig work than by putting it together. When it was finished he did many contacts, both domestic and DX,

but during his rest periods Randy tuned in on W1AW and practiced reading code for two months. When he thought he was up to about 14 to 15 words per minute, he asked his doctor about taking the General Class exam (even though he had nothing to gain band-wise), but the doctor did not approve since it meant sitting for well over his limit. Therefore he received a certificate of disability and a director of the local radio club gave him (the mail) examination for a Conditional Class.

Well, Randy made it! He doesn't know how well he did, but he remembers his shaking hand more than anything else about the code test (his spinal injury affects his entire nervous system).

Randy wasn't happy with the Conditional, because he thought other hams would look down their noses at him (and some did). So he went about improving his knowledge. I counted well over 35 ham books in the bookcase next to his bed.

He vowed he would go for a General Class even if they had to take him down in an ambulance. With 2 to 3 hours of reading each day (especially SSB), he took the chance on the one day the FCC would be in his city (only twice a year). Randy did a much better job on his General exam than on the Conditional. He made not a single mistake in code, and in theory was over 90. However, the expedition was costly in terms of the pain caused by going in for the exam. Now he is studying for the Advanced Class, but all this is not the moral of this true story.

A while ago Randy happened to be on what he thinks was someone's *private frequency?*, and so Big John bellowed in on Randy's QSO and said Randy was 12 kHz wide. At the time Randy was receiving and the other half of his QSO was transmitting. So Randy asked Big John to please stand by until his contact had completed transmitting and then he would discuss his signal with him. But Big John continued and insisted on pursuing the subject. Randy finally (his patience almost gone) said, "It sure is a mystery to me, if I am really 12 kHz wide and with SSB, and audio turned down below the flat topping point and my rig had just been returned from the factory for general adjustment." Just two weeks prior Randy had had his signal checked (on a scope) by a Navy technician, some 1500 miles away. "It is difficult ' said Randy, "to believe my one-year-old rig is really 12 kHz wide, that is so far out."

Randy's Navy contact was kind enough to allow him to adjust his audio gain and speaking distance from the microphone. He scratched a mark at the point or the position that the audio gain was not flat topping and at that point his signal was not over 3.2 kHz wide.

"Well," Big John bellowed, "I'll get witnesses." So while Randy was still in QSO with his original contact, Big John called in a few nearby ham friends and a discussion enused for some time.

Finally it became time for Randy to transmit to his contact. He mentioned what Big John had said. Randy's contact came back with a quick break, that Big John must have something wrong with his receiver or scope, because he measured Randy at 3.5 kHz wide – probably overload in the front end of his receiver. So after the QSO Randy apologized to Big John; only for the sake of peace.

Randy shrugged it off as just one of the so-called, self-appointed "police" for the ham bands. However, he vowed he would have his rig checked by the factory. At this point Randy had obtained a 550W PEP input SSB transceiver feeding a classic 33 beam forty feet up. He used mostly 15 meters. So he did send the rig back to the factory and they gave it a clean bill of health, including the ACL.

Randy decided maybe his voice did modulate heavily, so he backed away from the mike to about 8 or 9 inches with the audio gain set at a point before flat-topping and made sure his voice did not modulate the transmitter more than 150 mils, which is in accordance with the instruction book.

"One more project," said Randy, "before I get to the point where I cannot build any longer."

From a kit (IC Board) he put together a frequency marker that would calibrate 100, 50, 25, 10 and 5 kHz. Then he beat the marker with WWV three times to make

certain it was correct before the new incentive license change on November 22, 1969. In checking with other hams he found he was never more than a few cycles off (and maybe the other fellow was out) and these checks were with top-notch operators and equipment. He also checked the new marker with his built-in 100 kHz calibrator.

But lo and behold! After talking to a contact who was using the S Line, Big Chicken Little (self-appointed, who did not identify name or call sign) blurted into his QSO, "You are centered out of the band 5 kHz." Randy rechecked his calibration and was within 100 *cycles* of 21,440; muttering to himself, Randy said, "It is hard to believe," and asked what his anonymous contact was using with which to police him. The voice came back very loud and very wide, "You are 21,450 kHz." Throwing up his hands, Randy said, "Maybe this hobby is not for me, after all." *And I think he means it.*

I doubt now he will ever take the Advanced Class exam. Yet I believe he has the knowledge and is qualified.

While he was attempting to teach code to some youngers, he wondered why Extras insisted on getting exactly on 14,020 kHz, etc. So he wrote the powers in Hartford. You should read the reply from an Extra Class correspondent. Guess the answer.

An eyeball contact with Randy confirmed the following facts:

1. Two American passports with visas to almost 35 countries in every continent in the world.

2. An engraved gold Omega watch, stating he had been with his firm over 30 years.

3. Two patent documents in his name for inventions dating 1945 and 1966, one a medical device and the other an attachment which worked in conjunction with his company's electronic equipment.

In addition, he has managed to educate three daughters, two with advanced degrees, and the youngest with an electronic engineering degree from a top technical university.

Randy says: "It is not what the big shots say, it's the way they say it." I agree, and may our *over-enthusiastic, self-appointed "police"* learn at least the first lesson in human behavior. In spite of their knowledge of ham radio they can be wrong, or can they . . .

The other day Randy wrote his will with his lawyer, and among other bequests he ordered carved on his gravestone: "Just How Right One May Imagine Himself To Be, Is No Criteria In The Eyes Of God Or Man."

The big shots could have said, "Randy, when you have finished, may we have a QSO with you?" Then they could have said, "Randy, the QRM is fierce. Let's check the bandwidth of our signal so we will not be adding inadvertently to the problem."

Randy suggests that because he went to all the trouble to have his rig checked and readjusted is no admission that the "policemen" were right.

The moral to this story is: *"If you judge without all the facts, you must stand to be judged by others."*

. . . WN7KUD

Any similarity to names and places are purely coincidental and not intended except to those to which this story applies.

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Further Adventures Of The Bounceless Switch

I have presented several pulsers in past articles that hopefully have been of use to amateurs and others involved in pulse circuit testing ("A Pulse Generator for the Amateur," *73*, Nov. 1967, "An IC Pulse Generator for the Amateur Experimenter," *73* Sept. 1971, and "IC Logic Pulser Simplifies Design," *Electronic Products Magazine*, Aug. 16, 1971). Correspondence from readers indicates there is an additional need for a pulser which puts out only one pulse at a time – each time a manual "pulse" button is pushed.

What good is a single-pulse generator? Well, if one can really depend on obtaining one pulse per push of the manual "pulse" button, such a generator can be of great use in analyzing various count-up, count-down, and shift register circuits. For instance, there are as many different circuits for counting by various integers as there are logic designers. By first resetting an unfamiliar counter (usually by means of its reset input), then inputing one pulse at a time to its clock input, we can make up a truth table. This can be done using only the single-shot pulser and a dc voltmeter. An example of such use will be given later in the text.

It might be thought that a single pulse could easily be created by simply using a battery and a switch as in Fig. 1. However, although this method was workable in older relay logic systems, it has severe troubles in generating a single pulse for modern IC logic systems. The most obvious problem with a battery and switch pulser is that of the lack of ability to control the pulse length. Human response time being what it is, pulses shorter than, say, 100 ms are very difficult to time. The less obvious problem, however, (and actually the worst difficulty) is that nearly all switches exhibit some form of bounce. Bounce is the effect of a switch, on closure, to make and break the circuit several (or many) times before staying closed. In a spring-loaded switch, like a microswitch, the term bounce is quite descriptive; however in other switch types the mechanism of making and breaking is more subtle. The details involve microscopic cold-welding alternating with conductor-oxide insulation – but the result is the same: *bounce*. Since even the slowest forms of IC logic respond to on and off signals in microsecond times, switch closure bounce can be seen by the IC s as multiple pulse inputs for each apparent switch closure. This, of course, can cause great confusion when trying to understand pulse-counting circuits.

The single-shot pulser in Fig. 2 solves not only the pulse-length problem, but also assures that only one pulse is generated from

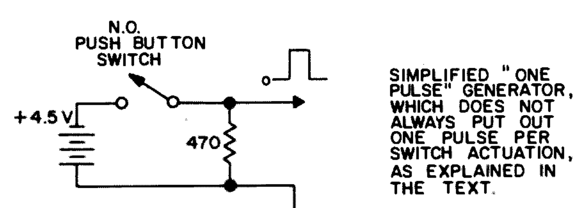


Fig. 1. Simplified "one pulse" generator, which does not always put out one pulse per switch actuation, as explained in the text.

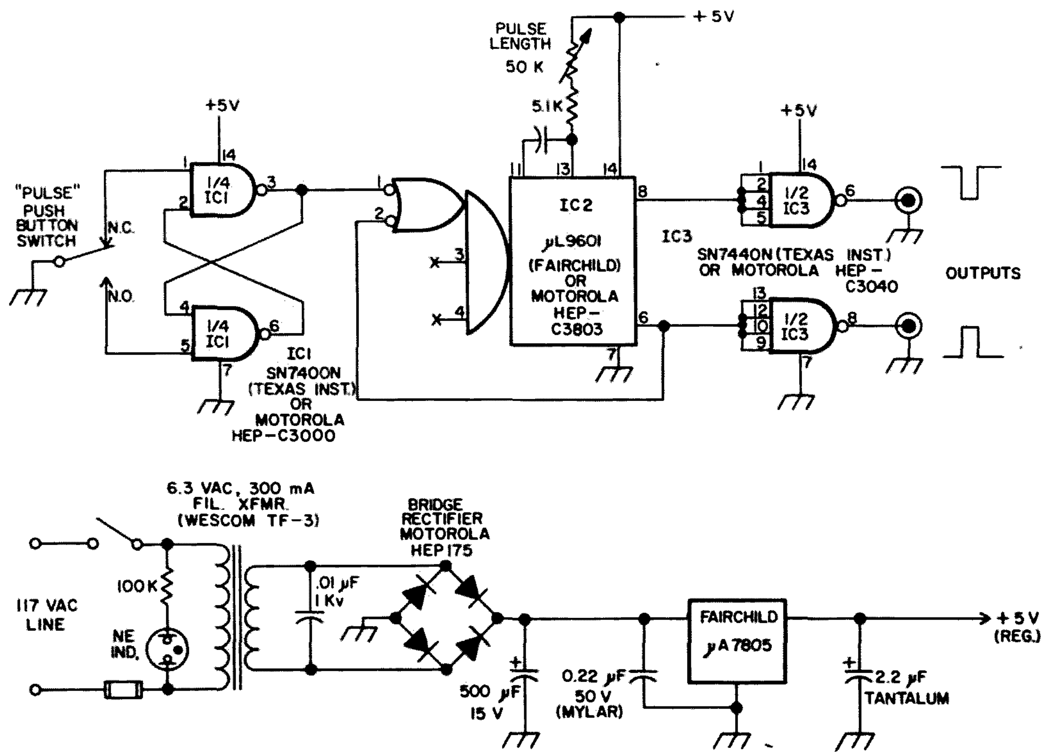


Fig. 2. IC1 = SN7400N (Texas Inst.) or Motorola HEP C3000. IC2 = uL 9601 (Fairchild) or Motorola HEP-C3803. IC3 = SN7440N (Texas Inst.) or Motorola HEP-C3040.

each actuation of the push-button switch (even if the switch bounces). The switch debouncer is a pair of TTL gates wired as an R-S flip-flop, sometimes called a latch. The latch puts out a negative going rectangular pulse, whose duration is dependent upon how long the push-button switch is held down. However, the output pulse length is not controlled by the latch output, but by the one-shot multivibrator (IC_2) which it triggers. The one-shot is one of the newer TTL types, which are much easier to apply than the older DTL one-shots; it is triggered only by the falling edge of the latch output, as it is wired. IC_2 has both Q and $\bar{Q}$ outputs available; that is, it has both a positive output pulse and its complement. These are available, respectively, at pins 8 and 6 of IC_2.

In order to provide as much output drive as possible from the pulser, each of the two outputs are passed through a TTL buffer gate. Since these gates are inverting types, the positive going pulse and its complement exchange output positions. The two buffer gates are contained in IC_3.

A simple regulated power supply is used to make the single shot pulser completely self contained. A 6V filament transformer, integrated bridge rectifier, and 500 μF capacitor form the rectifier-filter section. A Fairchild μA7805 integrated circuit regulator provides the regulation. This power IC regulator has only three terminals: input, output, and ground. Reasonably, the ground terminal is also the heat sink tab on the plastic version used (it is the metal case for the TO3 version); and so, no insulating washers are needed for mounting. In order to assure against oscillations (the IC has rather high gain internal circuitry), a 0.22 μF capacitor is placed directly across the input and ground terminals. There are several other similar fixed 5V regulators available which also could be used: the LM309 (National, EEP, Motorola) or the LM335 made by EEP.

A number of simple changes may be made in the circuits to allow for different requirements. As shown, the pulser will provide pulses approximately 1 μsec to 10 μsec long. Increasing the size of C_1 to 5100 pF will allow for pulses of 10 μsec to 100 μsec, 0.05 μF will give 100 μsec to 1 msec, 0.5 μF will allow 1 msec to 10 msec pulses. These capacitors must be non-polar types

Table 1
Equivalents for IC_1, IC_2, IC_3

UIC_1 = SN7400N (Texas Inst.)		IC_2 = μL9601 (Fairchild)		IC_3 = SN7440N (Texas Inst.)	
MC7400P	(Motorola)	MC8601P	(Motorola)	MC7440P (Motorola)	
USN7400A	(Sprague)	SN74122N	(Texas Inst.)	USN7440A	(Sprague)
N7400A	(Signetics)	N74122A	(Signetics)	N7440A	(Signetics)
U6A740059X	(Fairchild)	AM2601	(Adv. Micro.)	U6A744059X	(Fairchild)
SG7400N	(Sylvania*)	AM9601	(Adv. Micro.)	SG7440N	(Sylvania*)
HSC7400D	(Hughes)	RF8601	(Raytheon)	HSC7440D	(Hughes)
DM7400	(National)	DM7850	(National)	DM7440	(National)
TG-7440N	(Transitron)	SW9601	(Stewart-Warner)	TG7440N	(Transitron)
C3000	(Motorola - HEP)	C3803	(Motorola-HEP)	C3040	(Motorola - HEP)

*Discontinued, but often available as surplus stocks.

such as mica, mylar or polystyrene. If it is desired to use polar capacitors (such as tantalum electrolytics) a modified circuit for

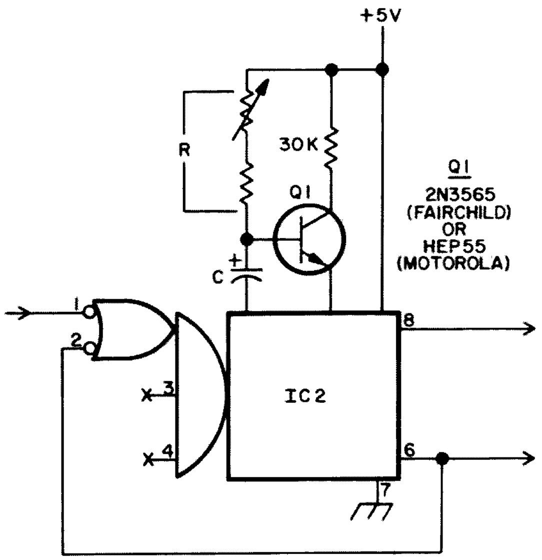


Fig. 3. Modification to allow use of polar capacitor (c) in one-shot timing circuit, and timing resistor (R) larger than 50K. Q_1 = 2N3565 (Fairchild) or HEP55 (Motorola).

the timing of IC_2 (Fig. 3) should be used. This circuit modification also allows the use of timing resistors larger than 50K, and so makes possible really *long* pulses.

If it is desired to have the single shot pulser drive 50, 75 or 93Ω coax cables, another change can be made. By substituting a Motorola MC3029P for IC_3 (with appropriate pin number changes), such coax lines can be driven without ringing and other forms of pulse distortion. Figure 4 shows the several ways in which the MC3029P buffer gates may be wired to drive TTL, 50 to 93Ω coax lines, and 93 to 120Ω coax lines. One may ask why the SN7440N was considered as the buffer in the first place when the MC3029P will provide its function plus the coax drive capability. The reason is that the MC3029P is rather a special case, made only by one firm – the "7440" is much more widely second-sourced.

As to substitutions, there are many sources of the SN7400N, SN7440N, and μL9601. Table I gives a listing for pin-for-pin substitutes that would be satisfactory in this circuit. In fact, one could even use DTL units for the latch and buffer gate IC's (IC_1 and IC_3). A μL946 (or MC846P) would directly substitute for the SN7400N, and a μL932 (MC832P) would directly substitute for the SN7440N.

An example of how the single shot pulser can be used is shown in Fig. 5. The pulser output is connected to the clock input of an SN7492N divide-by-twelve counter IC to ascertain what its truth table is (assuming we did not know it). We first actuate SI to the "1" position, which resets all the four flip-flops to zero. Then SI is set to "0" in order to count. The outputs Q_0, Q_1, Q_2, and Q_3 are each measured with a dc voltmeter (say a 20,000Ω/V V.O.M.). Now input one clock pulse by pushing the pulse pushbutton on the single shot pulser, and again measure the states of Q_0, Q_1, Q_2, and

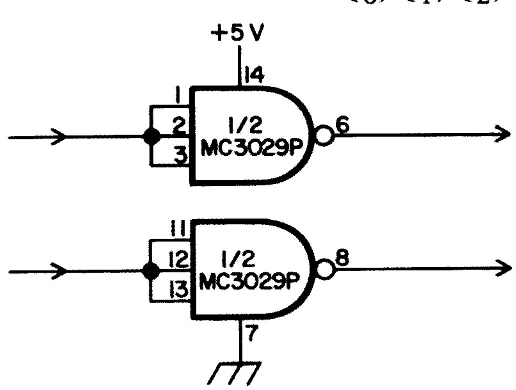
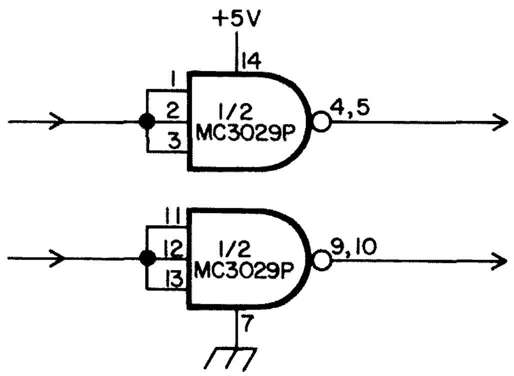
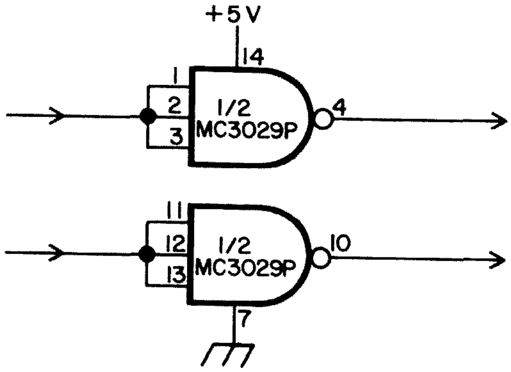


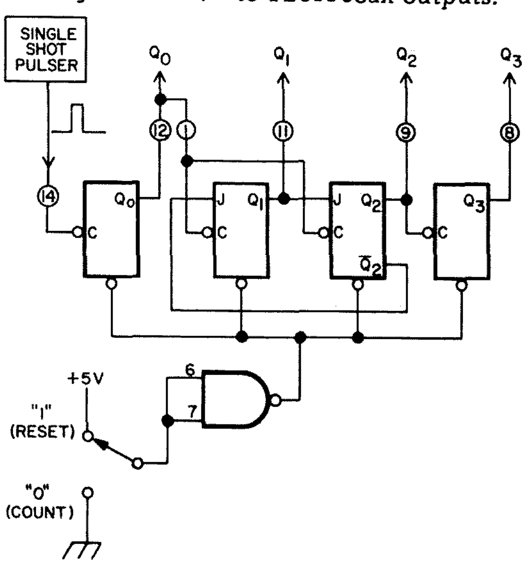
Fig. 4A. For T.T.L. outputs.



FOR 50 TO 93 Ω COAX OUTPUTS
Fig. 4B. For 50 to 93Ω coax outputs.



FOR 93 TO 120 Ω COAX OUTPUTS
Fig. 4C. For 93 to 120Ω coax outputs.



Count	Q3	Q2	Q1	Q0	Decimal No.
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	2
3	0	0	1	1	3
4	0	1	0	0	4
5	0	1	0	1	5
6	1	0	0	0	8
7	1	0	0	1	9
8	1	0	1	0	10
9	1	0	1	1	11
10	1	1	0	0	12
11	1	1	0	1	13

Fig. 5. Example of using single shot pulser to ascertain truth table of a counter IC.

Q3. Input another pulse, etc. In twelve pushes of the pulse button we can build up a truth table as shown. Note that *this* counter has a relatively unusual sequence; it counts up from 0 to 5 then skips to 8 and counts on through 13. There are still a total of 12 steps; so it is truly a divide-by-twelve counter, but the count sequence is somewhat unusual.

This example is one that needn't have been done, since the truth table of the SN7429N is well known, and published in the data sheets of its numerous manufacturers. However, there *are* plenty of nutty counters around made up of combinations of individual flip-flops and gates that are tedious to analyze. Running through a count sequence, as above, can quickly shed some light on their inner workings.

. . . W6GXN

1. Olson, H. "A Pulse Generator for the Amateur," 73, Nov 1967, p20.

2. Olson, H. "An I.C. Pulse Generator for the Amateur Experimenter," 73, Sept 1971, p112.

3. Olson, H. "I.C. Logic Pulse Simplifies Design," Electronic Products Magazine, Aug 16, 1971, p42.

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Is Automated CW Possible?

Many hams who are CW operators are awakening to the fact that the use of a tape recorder in conjunction with their ham stations can take a lot of the work out of transmitting, especially during contests. An article in *QST* September 1962, Magnetic-Tape Second Operator, gave W3GKP's sending system with a tape recorder, but it appeared more complicated than it actually was. and this may have scared off some possible uers of the technique. The following article will describe the simplest possible circuit for using automated CW transmitting.

In *73* June, 1962, my article "A Simple Electronic Keyer" appeared. An equally simple modification was made to this keyer to add the capability of sending pre-recorded magnetic tape messages. Figure 1 shows the

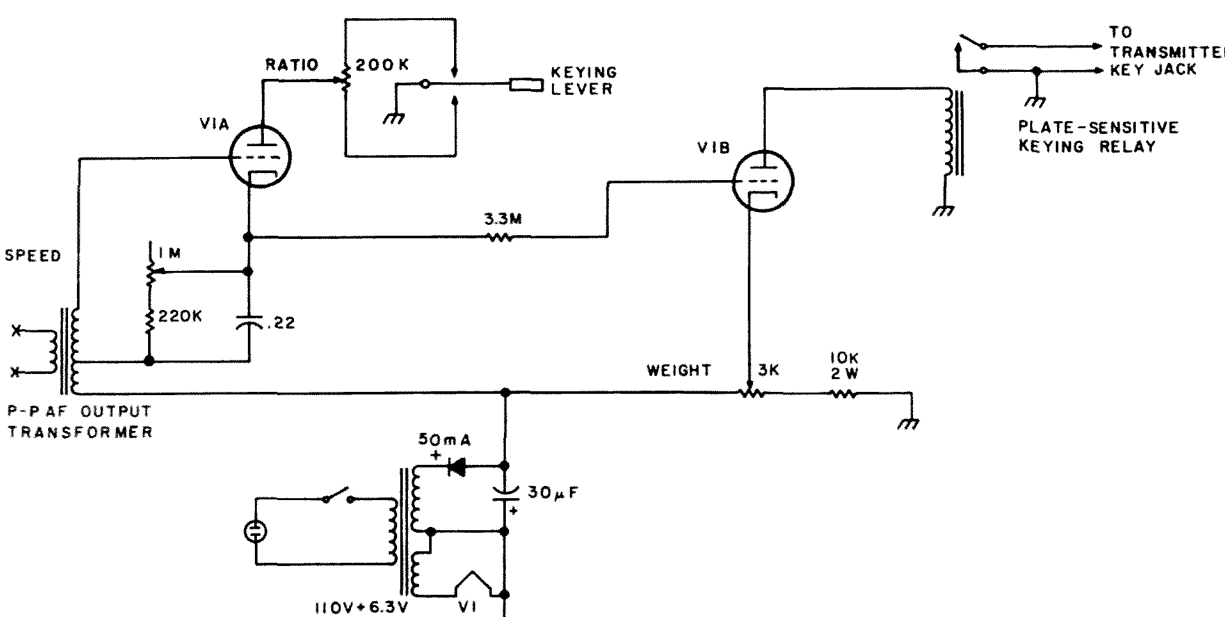


Fig. 1. The original keyer circuit.

original keyer circuit, and Fig. 2 shows the changes necessary. Referring to Fig. 2, the audio from the tape recorder is rectified by the silicon diode and filtered by the audio bypass capacitor. The resultant voltage actuates the plate-sensitive relay which was already used in the keyer circuit. The keyer operation is unchanged after this modification.

If you accidentally connect the diode with the wrong polarity, the keyer will not operate. This is because the polarity of the diode will be such that the current through V1b will follow the path of least resistance, through the diode and the tape recorder af output transformer to ground, and not enough to actuate the plate relay will flow through it. So if your keyer doesn't work after this modification, check the polarity of the diode. If it is in fact correct, then check to see if you have the keyer line cord plugged in. Further trouble shooting is beyond the scope of this article.

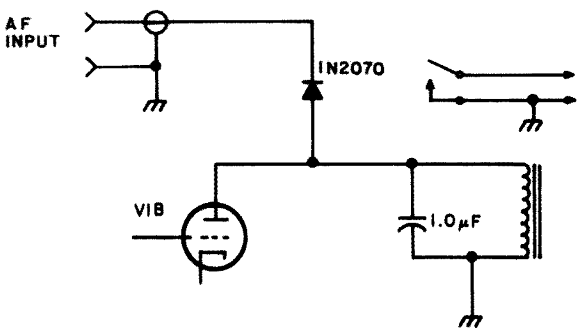


Fig. 2. Modified version of the keyer.

In case you don't use a keyer with a negative dc supply (with respect to ground), or want to build this second operator independent of the keyer, just use the circuit as shown in Fig. 3. It can be built into a small minibox, with no power requirement, or it could be built into the tape recorder becoming an on-off keyed circuit. Various other possibilities will suggest themselves to match the individual ham station.

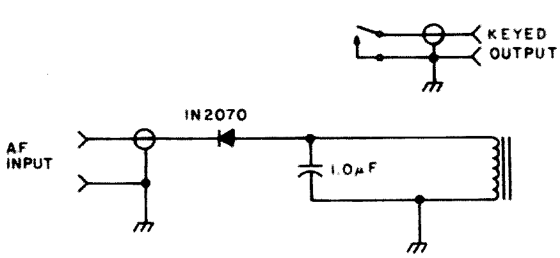


Fig. 3. Use this circuit to build independent unit.

It should be mentioned that the parts specified in this article are junk box values and represent simply what was on hand at the time the idea was tried out. Any diode which will handle a few mils will do for the rectifier, and any af bypass condenser value from 0.1 to 1.0 μF will be OK.

So that's all there is to the construction of the gadget. What could be simpler! It has been convenient in my station to place the recorder on a small shelf beside the operating table and permanently connect it with patch cords to both the electronic keyer and the receiver (more on this later). Now let's consider some of the possibilities with the set-up.

As W3GKP suggested in his article, it is possible to buy an older model recorder in fair condition at a reasonable price. For this application, you don't need anything approaching hi-fi, so you may be able to pick up a recorder still in good mechanical condition simply because its audio quality is not up to modern hi-fi standards. However, if you want to use the family recorder rather than buying one just for the ham station, this circuit is ideal, since no modifications need be made to the recorder to use it.

If you do buy an older recorder, something that's worth looking for is one with two playback heads. This type of recorder will play with the tape moving in either direction, rather than having to manually swap the two reels to reverse the tape direction. I managed to get hold of a good old Webcor which has this feature, so that two different messages can be recorded on the two tape tracks, and either track played back simply by selecting the appropriate tape direction by the selector switch.

Thus, in an ARRL Communications Department Party (in which the transmitted half of the contest exchange is always the same for any given station), a tape loop was prepared with a "CQ CD" call on one side of the tape, and an "ORS WPA" report on the other track. The actual texts of the two messages were chosen so they were of the same duration, and recorded with the same index point on the loop. Then it was a

simple matter of starting the tape to call CQ until it had had time to attract some attention, then stop the loop at the index, sign "K" with the keyer, and listen for a reply. If a reply was produced, the station's call sign was signed by keyer (manually) and the second tape track started. This gave the contest exchange for my station (K3KMO) while the log was filled out. Then when the tape loop had run, the tape was stopped and the incoming half of the exchange copied, with all log-keeping up to date and ready for a new contest when the transmission was receipted for.

However, woe be unto him who falls asleep with his automated station calling CQ, for his call sign shall be eternally remembered. . .

It is surprising how much of the work of a contest can be eliminated by such automated sending taking care of the repetitious transmissions for you. When the contest is hot, it helps the operator keep his logging caught up. When the contest begins to thin out, the operator can turn on the endless loop and call CQ until he rounds up the last few strays, and he can sit back and relax a little. However, woe be unto him who falls asleep with his automated station calling CQ, for his call sign shall be eternally remembered, his fame shall be known far and wide, and his name shall be mud forevermore!

W3GKP mentions in his article that he records his tape loops by taking the af output from his receiver while monitoring his transmitter (with the final turned off, naturally). This is a very easy technique. Also you can use your normal station monitor to do the same things. However, W3GKP failed to mention something regarding the recording of his own signal in his receiver that should be fairly obvious – the same thing can be done with any incoming signal. Thus, you can record another ham's signal and play his first back to him through your keying unit to show him what his sending is like. With careful adjustment of the receiver audio note and i-f bandpass characterisitcs, it is possible to eliminate most interference and get a good quality recording of any average signal. A little experimentation will show you the best tuning technique to use with this trick.

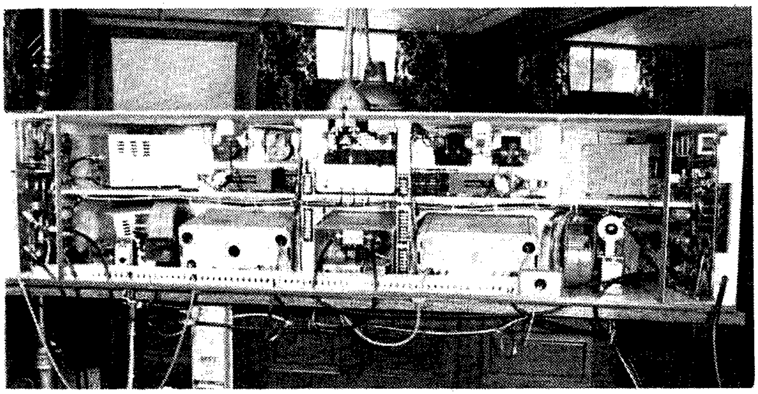
Also, recording and playback through the keying unit can be used to pass traffic on the CW nets – that is, if you are not ashamed of sending the other fellow's fist over your call sign! If this is done, the traffic should always be copied by hand simultaneously with the tape recording, to insure that you have a solid copy.

Another good trick is to use a two-speed recorder to either double or halve the transmitting speed. It is fun to use this technique at both ends, and make all the kids on your block think you and your contact are real speed merchants. However, you may attract the attention of an honest-to-goodness speed merchant, and be embarrassed. So be careful.

Numerous stations are helping to supplement W1AW's code practice transmissions nowadays by re-transmitting their material on six and two meter MCW or CW to help the Technicians over the code hurdle. This can be done quite easily with this tape-transmitter. Also, this gives you the capability of feeding the receiver audio output right into the keyer af input, so you can re-transmit directly. A switching arrangement can be used to kill the automatic relay when W1AW is signing its call, so you can take the opportunity to sign your own station call sign.

The possibilities of a recorder-operated station are almost limitless. You can add many more uses than those mentioned in this article. For instance, you too can have a CW phone patch such as I once had. Or you could help a physically-handicapped person with a unit for him to send CW by speaking "di-dahs" into a microphone. You can supply many more uses of your own.

I have played around with completely pre-recorded chatter for an entire contact, so that all he needed to do was to start the recorder calling CQ, then after receiving a reply, sign the call sign of the calling station and then let the recorder take over. If the tape-recorded QSO trend catches on, it may end up with two hams' recorders talking to each other while the two operators go out and have a beer. . . . **DJØHZ**



In between working one hundred countries on slow scan, Gene has done one of the better jobs of putting together a console for his station. Take a look at it . . . it took him over five months to whomp this up. Take a peek at the front cover and you'll see that Gene has left little out. Digital clock (local time) – dummy load indicator – antenna indicator – antenna control and main power control – speech processor – temperature indicator, in and out (Heath) – frequency display (Heath SB-650) – tape recorder – tower lights – 75S 0 32S – dummy load – slow scan unit – tower up and down – digital clock on GMT – SSTV monitor – elapsed time meters – antenna height indicator. Antique addicts may be horrified to learn that the base of the console is a 90 year old roll top desk made of solid oak. The front panel is made of white leather finish Formica while the top and ends are oak Formica to match the desk. The back of the console is enclosed with 1/4" (6.35 mm . . . hi) Plexiglass. How Gene was able to build this beautiful and neat console and still keep his oar in there to be the first to work 100 countries on slow scan is a mystery. Either chore would seem enough for any energetic amateur to accomplish.

C31HD – ANDORRA	LU7AAG – ARGENTINA
KC4USX – ANTARCTICA	LX1SK – LUXEMBOURG
CN8HD – MOROCCO	OA4F – PERU
CP1FW – BOLIVIA	OD5HC – LEBANON
CR6CA – ANGOLA	OE6GC – AUSTRIA
CT1PG – PORTUGAL	OH5RM – FINLAND
CX2GB – URUGUAY	OK1NH – CZECHOSLOVAKIA
DJ0CN – GERMANY 1971	ON4DN – BELGIUM
DJ7UP – W. GERMANY 1973	OX3LP – GREENLAND
DU1FR – PHILIPPINES	OY1M – FAEROE IS
EA4DT – SPAIN	OZ4IP – DENMARK
EA6BQ – BALEARIC IS.	PA0LAM – NETH. AMSTERDAM
EA8CI – CANARY IS.	PJ2CU – NETH. CURACAO
EL2CB – LIBERIA	PY2EEG – BRAZIL
EP2FB – IRAN	PZ1DA – SURINAM
ET3DS – ETHIOPIA	SM4AMM – SWEDEN
F6AXT – FRANCE	SV1CG – GREECE
FG7XT – GUADELOUPE IS	K4PGM/TI7 – COSTA RICA
FL8BH – FR. SOMALILAND	TJ1AX – CAMEROON
FM7WW – MARTINIQUE	TR8WR – GABON REP
FP0AO – ST. PIERRE IS.	TU2DO – IVORY COAST
G5ZT – ENGLAND	VE6RM – CANADA
GC3YIZ – GUERNSEY IS	VK5MF – AUSTRALIA
GI3WWY – N. IRELAND	VK9XX – XMAS IS
GM3KJF – SCOTLAND	P29MC – NEW GUINEA
GW3DZJ – WALES	VP2AR – ANTIGUA
HA7LF – HUNGARY	VP2ME – MONTSERRAT
HB9IT – SWITZERLAND	K4GXO/VP7 – BAHAMA IS.
HB0NL – LIECHTENSTEIN	VP9GR – BERMUDA IS.
HC1BU – ECUADOR	VQ9R – SEYCHELLES IS.
HK7XI – COLOMBIA	VS6AI – HONG KONG
HL9WI – KOREA	VU25KV – INDIA
HP1XMU – PANAMA	XE1JM – MEXICO
HR2HH – HONDURAS	XW8AX – LAOS
HS1AHE – THAILAND	YN3RBD – NICARAGUA
HZ1SH – SAUDI ARABIA	YU2CDS – YUGOSLAVIA
I1LCF – ITALY	YV5AS – VENEZUELA
IS1PEM – SARDINIA	ZF1AO – CAYMAN
JA7FS – JAPAN	ZL1AOY – N. ZEALAND
JY8AA – JORDAN	ZS6UR – SOUTH AFRICA
W4MS – USA	ZS3B – SOUTH WEST AFRICA
KC4DX – NAVASSA	4X4VB – ISRAEL
WA6AXE/KG6 – GUAM	5W1AT – W. SAMOA
KH6DEH – HAWAII	6Y5PB – JAMAICA
KL7DRZ – ALASKA	YB3AAY – INDONESIA
KP4GN – PUERTO RICO	8R1W – GUYANA
KS6DW – SAMOA	9K2AM – KUWAIT
KV4CM – VIRGIN IS.	9Q5BG – REP. OF CONGO
KX6DR – MARSHALL IS.	9X5PB – RWANDA
LA3SG – NORWAY	9Y4VU – TRINIDAD

COVER

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W8YEK Works 100 Countries on SSTV

I have 91 countries confirmed. Herewith is a list of the 100 countries I worked 2XSSTV. Also a list of the ones that did not QSL so far. Some were recent contacts.

EA6BQ was country #100.

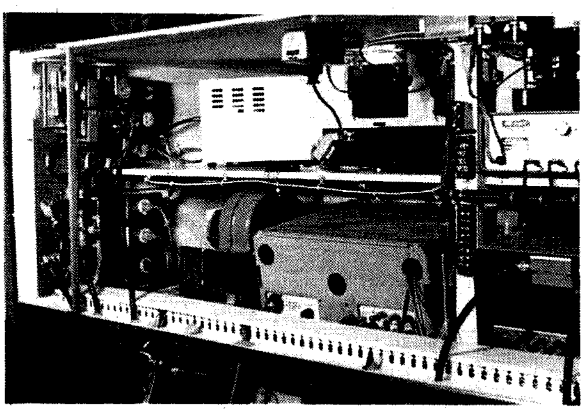
I also had a two way with TI2GSW and no QSL from him. I did hear that EP2FB sold out, so that card is lost. I may have to work 115 countries to get 100 cards.

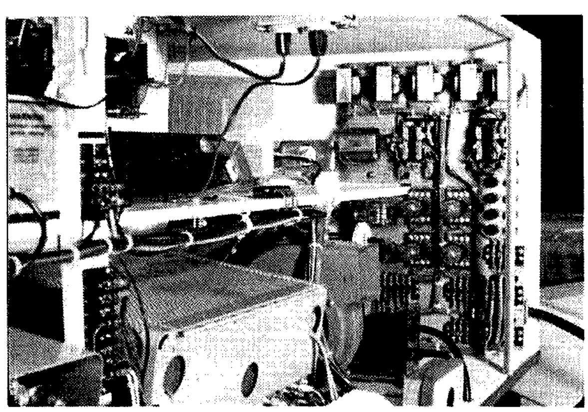
I worked Faisal (HZ1SH) several times and did not know who he was so I thought maybe the poor guy was hard up. I enclosed IRC's and still I received no card. So I did it again, IRC's and all. Then I picked up a newspaper one day and there it was – Faisal puts oil embargo on USA.

1	EP2FB	JAN. 4, 1973
2	HZ1SH	JUN. 15, 1973
3	K4PGM/TI7	MAR. 24, 1974
4	C31HD	AUG. 6, 1974
5	FL8BH	AUG. 14, 1974
6	CX2GB	AUG. 20, 1974
7	GM3KJF	NOV. 1, 1974
8	HC1BU	NOV. 2, 1974
9	EA6BQ	NOV. 8, 1974

I operate 10 to 12 hours a day, 7 days a week in the winter and in the summer 2 to 4 hours a day. I find that if you want to work 'em you have to be on the air a lot. If I receive any QSL's from the above 9 I will drop a note to 73.

. . . W8YEK





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Joys of The One Night Stand

How do you get your kicks in ham radio? Depending on the individual there are many ways. Some spend their time strictly on CW, some on phone, some are rag chewers. Some spend all their time on the nets, some chase DX, and some do nothing but build new gear. There are those that spend their time mobiling. And some think QRP is the only way to fly, while others have to have stacked yagis 100 feet high with the legal limit of power. Still others find overseas phone patching is their thing. Choose your own poison.

We get our kicks from portable operation of the temporary one or two night stop. We have hammed from camp locations by the hundred and to some extent from motels, beach cottages, mountain cabins and other permanent structures. We have alluded to this in several articles previously which will be noted as we go along. The purpose of this article is to relate a few of our adventures in the world of hamming while traveling, but not mobile. We hope a few more will join the fun.

Just setting up camp, cooking your meals, hiking and fishing can be a lot of fun. But eventually you run into some time that you don't know what to do with. The fish quit biting or you are tired of walking around and then it is time to set up the portable ham gear and enjoy a little hamming. You can get quite a kick out of just telling the guy who is sweltering in 100° heat how nice and cool it is up in the mountains. Or maybe you have need to get a message back home and you are 50 miles from a telephone. Either way hamming is a mighty fine adjunct to camping. It can be fun whether you camp in a tent, a trailer, a camper or a 20 kilobuck motor home.

What Type of Rig Do You Need?

Generally, if you are going camping, you are not likely to have an ac line. So it is highly desirable to have a rig that will operate from a storage battery. A number of the Swan family have dc modules available, but most are hard on an outboard storage battery. A Swan 350 will go through a heavy duty storage battery in less than 5 hours. This is OK if you are going to be out for no more than a couple of days and expect to do more fishing than hamming. The new solid state Swans should do much better. The SBE33 and 34 are excellent for battery drain. We presently have an FT-101 which has never run our heavy duty battery clear dead. We believe it will run for 12 hours. And 12 hours is a lot of hamming before you get to the next place that you can charge the battery. Obviously any of the solid state QRP rigs will run for days from a big storage battery. If you are traveling to motels or with a motor home with built in ac power, anything portable with less than a Mack truck is fine for portable operation.

Power Supplies

As mentioned above we would regard a heavy duty storage battery as a prime source of power. Now, none of the aforementioned rigs will actually deliver full rated power from a battery. In general, they are designed for mobile use with the car generator charging at all times. This means about 14V. We have an extra cell for our battery, making 14V. You still don't have full power but you have more. *Caution:* Read your instruction book before adding an extra 2V! The only other power possibility, aside from a possible ac line being available, is a portable gasoline generator. We have a Zeus capable of furnishing all of the power we could possibly want but we very seldom use it. It is driven by a cheap lawnmower type engine which is noisy. If you are camped within 91.44m (100 yards) of a neighbor camper you will be about as popular as a small kid riding a motor bike all around camp. The problem is not exhaust, its the motor itself. Even with a good muffler you still have the clank of a cheap engine. The Honda company makes the quietest portable gas gener-

ator we have used. You can talk into a mike less than 6.1m (20') away from the engine. Apparently they machine their parts a little better than the Americans. If you can get on the outside perimeter of a camp ground and then run an extension cord back into the woods for 30.48 meters (100') and use a good muffler the gasoline generator is a good way to go.

Antennas

By and large the simplest antenna to get going is the dipole. A forty meter dipole will work on 40 and 15m. Once measured the correct length it will get by regardless of the height. In the good ole days Amphenol and others made 72Ω ribbon that was smaller than zip cord and all you had to do was zip out 33 feet and tie a knot in it, the remaining length being feeders (60+ feet each side if you are interested in 75 meters). This writer would be most happy to buy a couple hundred feet of 72Ω receiving twin lead if anyone has some back in the attic or down in the basement, because it is simply not available any more. However, ordinary twin lead rubber zip cord is not bad. Z_0 is about 95Ω. Losses are unknown. But we have had many 40 and 15m contacts, including some DX ones, using 10.06 meters (33') of zip cord each side of a knot.

Now as to getting the antenna up in the air. Naturally the higher you can get it the better, but it *will* work even if tied between two picnic tables. We worked VK land with a dipole draped on blackberry bushes less than 8 feet from the ground, from an Oregon beach campground. But our favorite method is to shoot a two ounce fishing sinker attached to the spinning rod, over a tree limb, with a sling shot.[1] We then reel the fish line back in with nylon cord attached and hoist up our antenna. If you are a baseball pitcher maybe you can throw a weight over the limb or spin a weight around and around releasing it at the proper time. In any event you need a spool of nylon cord.

Next to the dipole the ¼λ ground plane would be most important, especially if you are interested in working the higher frequencies. We presently have a portable

ground plane made of telescoped aluminum tubing which will telescope from 2.44m – 4.87m (8' – 16'), thus covering 10, 15 and 20m. Cost for two of these was less than $12. We use the roof of a Ford van for the ground plane. However, the vertical element may be a wire secured to a limb overhead or even a pole wrapped with kitchen aluminum foil.[2] And the ground plane may be random wires on the ground. The main trouble with a ground plane in camp is the radial wires being where people trip over them. This could be alleviated by making the bottom of the vertical element and the ground plane 2.44m (8') from the ground. This usually presents construction problems though.

Last but not least comes the quarter wave Marconi antenna. This is especially good for 40 or 80m and the motel traveler. Again, once you get the length established you can expect to stay under an SWR of 2:1 for nearly all cases. Measure out a quarter wave length of wire. (From the standpoint of public relations the smaller the wire the better, and erecting after dark is not a bad idea either.) Use 50Ω coax (NOT 72Ω) and hook the wire to the hot lead. Connect the

shield to anything that looks like a ground. The ground can be a vent pipe on the motel, an eave trough, a steel railing on the upstairs tier, even an aluminum screen door. The closer to perpendicular to the assumed ground that you can go with the wire the better, although even practically parallel *will* work. In the latter case you might have to adjust the length of the wire by a foot or two to get under 2:1 SWR. A dipole is fine for a motel also, but difficult to attain with the feeders at your apartment. Needless to say you have to be on pretty good terms with the motel manager to put up a 75m dipole across the front wings of the motel. So we used the quarter wave wire in 30 or 40 motels all over ZL land where they usually have metal roofs for the substitute ground.[3]

Some Examples of What You Can Do Operating Wise:

Much has been speculated about the effects of trees on radiation. Our observations at least in the summer time, is that trees don't really affect things that much. On the lower frequencies you can work as far as you can at home with the same power with or without trees. We have made WAC several times in a forest so thick you couldn't see through and with the antenna half as high as the trees.

If you have need for a low frequency antenna don't assume the one you have up is useless: it may work. A 40m dipole will not work on 80 the good book says. If you have a short haul situation to get back home go ahead and load it up to something less than rated power. You can work 100 miles or so with no difficulty. You may have a 3:1 SWR but at half power it won't hurt for a few minutes. You can break a net and get your message through. By the same token a 40m dipole won't work on 20 either. We had one up about 50 feet recently and didn't want to get out the ground plane for 20 so we checked the SWR which turned out to be 1.5:1. So we fired up the FT-101 and worked Florida on the first contact.

The worst antenna we ever had worked for at least 200 miles on 75 meters. We were in a motel practically in the center of Dunedin, New Zealand, on a main traffic lane. There was absolutely no place to hang an antenna. We clipped the shield of the 50Ω coax to the roof and draped about 60 feet of wire on rose bushes less than three feet high around the end of the building in the shape of a "U." We did have to adjust the length of the wire to get less than a 2:1 SWR but we worked several stations and even got invited out to dinner. I suppose the best antenna was a 100 foot water tower in Merrill, Oregon, which we shunt fed.[4]

While in ZL land we occupied ZL1KN's beach cottage in Whangamata, New Zealand, for about 10 days where we mounted our whip antenna on top of a rotary clothes line and, using the clothes line for a ground plane we tuned up our SB 34 on 20 meters. A neighboring boat builder and his wife came over to visit one evening and he wanted to see how ham radio worked. We turned the rig on and a CR4 in the Cape Verde Islands was calling CQ. He answered and gave us a 5 by 6 report. Sometimes things work when you want to show them off!

Several years ago we stayed at a motel at Shasta Lake in California on the second deck. We laid our 40 meter dipole on the wooden railing and the first station we worked on 15 meters was in Korea. This was with the SB 34. Another time we were camped in Colorado near the Air Force Academy. Our camp was at the foot of an earth filled dam 50 feet high. We were less than 50 feet from the face of the dam on the south side. With a Swan 350 and a fiber glass fishing pole wrapped with wire we worked a Russian in the Ural mountains at 10 o'clock at night on 15m. His direction was directly into the face of the dam. Maybe it came the long path, I don't know. Anyhow, you can have a lot of fun operating from strange and different remote locations. Give it a try.

1. Antenna Matching Systems, W7CSD, July 1973, *Ham Radio*
2. The Poor Man's Occasional Antenna, W7CSD, Feb. 1967, *73*
3. An Oregon Yankee in Kiwi Land, W7CSD/ZL1BHC, June 1972, *Break In*
4. Ready Made Emergency Antenna, W7CSD, July 1961, *73*

. . . W7CSD

Installation

If necessary, a small miniature relay may be used for K1 to control a heavy duty relay for transmitter switching. In my station, the necessary 12V was derived by rectifying the 6.3 vac filament lead. A large capacitor provided filtering. In case a high current relay coil causes chattering, the alternate relay controlling a relay method may be preferred. The relay contacts are used to turn off and on the B+ to the plates, control the antenna relay, control the receiver, etc.

I built my circuit on a small vector board mounting all components except the relay. The board was mounted on top of the transmitter chassis. The relay was then mounted under the chassis near the power supply circuits. The switch normally used to change to the transmit mode was rewired so the relay could also control these voltages. Wires were routed through the transmitter to connect the relay with the vector board. The delay potentiometer was mounted on the front panel, as well as a switch to disconnect Motorola 1N4736 but a substitute may work. One word of caution; diode D1 must have a high enough peak-reverse-voltage rating in order not to fail. Make sure the key-up voltage across the key terminals is less than the p.i.v. rating of this diode. Here again a low leakage diode should be used.
opening relay K1 and the transmitter power circuits.

Once the key is closed, however, the voltage across C1 decreases to ½V, causing zener diode D2 to not conduct. This will in effect cause Q3 to conduct, turning on the relay as well as the transmitter. Once the key is up, charge is allowed to build up on C1, and when the voltage reaches 6V, the relay opens. Thus, a delay of R1C1 will occur after each key-up.

Transistor Q1 should be a high gain NPN. I used a 2N3565, but any small signal type should work equally well. Transistor Q3 should be able to handle the current of the relay. I used a 2N4401 which is able to switch about 500mA. Q2 is also non-critical. Diode D3 is used as transient protection for Q3 and must be installed correctly. Damage could result to Q3 otherwise. Zener diode D2 should have low leakage current. I used a power from the circuit. This allowed me to operate in the normal mode, i.e., with the quasi-break-in out of the circuit. Since the relay contacts parallel the main transmitter control switch, either switch or relay may be used to put the transmitter in the transmit mode. An extra set of contacts on the relay allows the receiver to be disabled during key-down periods.

As mentioned previously, the amount of time delay after sending code is determined by the R1C1 time constant. With the values shown, a delay range of ½ to 5 seconds was measured. More or less delay may be made by respectively increasing or decreasing the values of R1.

I have used this type of quasi-break-in for several months and have noted an increase in operating efficiency and pleasure. It is very convenient to be able to just tap on the key in order to transmit during a QSO. This circuit can be adapted to your transmitter at little expenditure of time or money. In fact, even Wayne probably has time between editorials to build it!

...WA5KPG

F. E. Hinkle, Jr. WA5KPG
9503 Gambel's Quail Trail
Austin TX 78758

KOX for CW

Something like VOX

VOX was invented for the lazy phone operator. Probably by a lazy operator. Phone operators have been using VOX systems since the advent of SSB. The manufacturers of ham gear have carried this over to the application of VOX during the CW mode of operation. Though this greatly simplifies the operation of the station, everyone who operates a commercially bought rig will admit that the CW features in today's SSB designs are not meant for ardent CW men.

I was trying to modify a friend's transmitter to the quasi-break-in system because it is cheap and easy. In their enthusiasm to simplify CW operation, the operators have devised the most complicated break-in systems. What ever happened to the simplified system, the ones you can throw together, adapt to any rig, have worked every time, and that don't take a week to build or install?

I came up with a simple design that would open and close the voltages to the transmitter when the operator wished to send CW.

Familiar to most, quasi-break-in is a system where the station stays in the receive mode until the operator desires to send the code via a key or keyer. Any tapping on the key causes the transmitter to switch into the transmit mode, and stay there a defined period after the last character is sent. This period of delay, before the transmitter is de-energized, is usually adjustable by the operator.

Since the quasi-break-in does not allow the operator to hear the other stations between his character sending, this is not a true break-in system. However, since the automatic transfer of power does occur with the first character sent via key, operation is speeded up. This is very desirable in operating a CW station. Quasi-break-in is a simple circuit and may be added to existing transmitters or designed into new ones. Since a power relay handles all of the high voltages in the transmitter it is safe to operate. Of course, the relay may be used also as an auxiliary switch for other relays.

Operation

Basically, the circuit works as follows: Diode D1 is used to protect the circuit from high voltages which may occur during key-up situations. D1 is reversed biased when the key is up. This allows capacitor C1 to become charged through resistor R1. This R1C1 time constant determines the variable delay of the circuit. This is the reason a variable resistor is connected in series with R1. Transistor Q1 is a voltage follower which isolates the charge on C1 from the rest of the circuit. Once the voltage on C1 reaches six volts, diode D2 is allowed to conduct. D2 is a 6V zener diode. No conduction takes place until at least 6V are across D2. The firing of D2 allows Q2 to turn on as current flows through D2 and the base of Q2. This causes Q3 to turn off,

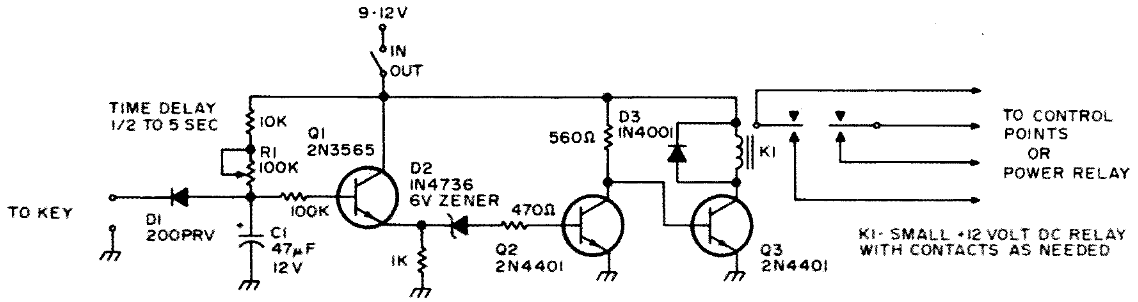


Fig. 1. Schematic of Quasi-Break-In system for use with cathode keyed transmitters.

LETTERS

Continued from Page 22

SHAME ON W5JJ!!

W5JJ ought to have an FCC monitor permanently assigned on his lawn for such a travesty of an article appearing in your June 1974 (p. 33) issue.

Most of us have thought about such schemes, but who in his right mind (2 letter call, yet) would publish it for all newcomers and ole timers alike to fabricate from scratch?

At least a small diagram so newcomers would stay in the band! Assorted oscillators will appear with regenative tones modulating, sliding back and forth across commercial circuits, WWV and naturally TV. W5JJ proposes more power than hams with pride would use QRP!

K1CLL is a man after my heart with his thrown together circuits — deliver us from W5JJ, unfit for April CQ Magazine.

Shades of 1931, light bulbs coupled to an oscillating tank circuit! Please allow me to expose that which HF, VHF and UHF commercial folks have been using for years — the simple RHO 'tector as sold by Telonic, Texscan and Wiltron companies, to name a few.

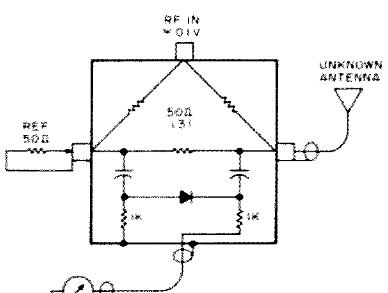


Fig. 1.

PARTS LIST

3 ea. 50Ω ¼ w (5%)
2 ea. 100pf ceramic capacitor
2 ea ≈1000Ω ¼ w
1 ea diode IN34,-82 etc.
1 ea Ref 50Ω (¼w) 5%
1 ea ≈100 Microamp meter

The circuit is a bridge — a 50Ω (or any pair of equal loads) on the unknown terminal will balance the 50Ω Ref load and the meter reads zero. Make other Ref loads of 100Ω, 150Ω etc., for VSWR check points of 2:1, 3:1 etc. Leave the unknown terminal unconnected and put in enough rf to read full scale on the meter; connect a 2:1 or 3:1 Ref. load and note the meter reading — a complex VSWR of same value will read at the same point.

Couple into the bridge with a grid-dip meter and move the dial slowly through the band of interest — band edges can be found quickly.

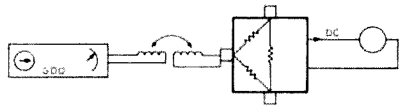


Fig. 2.

The Ref 50Ω can be built into the box with the other parts and save a connector and having to build a resistor into a mating connector. Built in meter makes it compact.

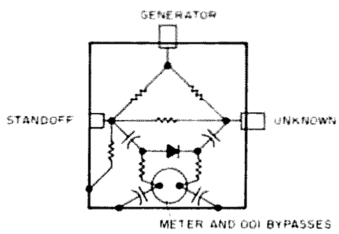


Fig. 3.

For those with a sweep generator — Heath TV alignment, B&K Precision, or other types sweeping over a wide range with a saturable reactor, are pretty good and available used — a 'scope gives a spectrum VSWR response.

Expanded scale measurements can be made if a standard mismatch (100Ω, 150Ω, 200Ω for 2:1, 3:1, 4:1) is used on the unknown terminal and the G.D.O. or signal generator is applied with enough voltage to give a full scale reading — then full scale is that ratio of the known (Ref) to the standard mismatch on the unknown terminal, i.e., 33Ω on Ref and 100Ω on unknown gives VSWR of 3:1 when set to full scale.

Write for data sheets from Texscan and an application note from Wiltron. Their devices for sale are in machined stainless steel with precision connections, but we homebrewers can live with phono connector, binding posts, BNC or other easy to connect devices. For BNC mount 3 of the chassis type UG-625 or UG-290 in a tight triangle to keep lead lengths to a minimum — the meter connector can be on an edge of the box. Photos of several homebrew versions on request.

Now, don't you think this is better than W5JJ suggesting that any available tube (813, 4PR60A etc.) be pressed into slapped together oscillator service?

Paul H. Sellers ex-K3IEW
Norfolk VA

REPLY

Thanks for forwarding the comment on my article! It's both amusing and enlightning to note the attitudes of persons when views or practices are voiced that do not coincide with their narrow preconceived conceptsl

Please excuse my delay in commenting. As I'd told you, I'd planned to spend the summer and fall in Europe. But fate intervened. Instead, I went to a hospital for an operation on my spine and am just now getting able to sit in front of a typewriter. . .with my neck in a brace!

How does this chap ex-K3IEW know what power I used on my Hartley oscillator? (And why is he ex? Did he have a Lazy Liars License and get called in by the FCC to pass a real examination. . .and flunk?)

As a matter of fact, the power used was just slightly greater than that of the Measurements Corp. "Megacyclemeter" (a superior form of griddip meter sold for laboratory use) which had been used in some of the preliminary stages of the series of antenna experiments. The power radiated probably was within a dB of that of the "Megacyclemeter."

Also, I had used an "Antenna Noise Bridge" furnished to me by Ted Hart, the man who invented it and who holds the patents on it.

Both of these conventional devices functioned quite well until the stage of experimentation at which so much resistance was coupled into the antenna that neither could furnish a dependable indication. Then I dug out

the "Shades of 1931" that horrified ex-K3IEW. You know, Wayne, just because a technique has been known or available for many years is not an infallible indication of the utter worthlessness of the technique!

So it proved in this instance. The Hartley oscillator (built in 1929...not 1931) plus a simple lamp indicator performed what "state of the art" devices had failed to do: Indicate resonance on an antenna with high induced resistance.

As for the amazing techniques outlined as prime information by ex-K3IEW, are they in any manner different than those employed in common use by those who are aware of their sharp limitations? Not to mention by a much larger number of persons who are not aware of such limitations. It's the later group that comes up with some of the wild and totally baseless ideas about the performance of antennas and transmission lines.

In his bombastic effort to establish his omniscience, ex-K31EW completely overlooked (or ignored) the one simple, basic principle: Keep it simple. An amateur who doesn't have access to a stack of laboratory equipment (or, in my case, even one who does) can make effective use of equipment on hand (or that can be built from any hellbox) to perform evaluative measurements.

Thank you, Wayne, for listening to my explanations.

Carl C. Drumeller W5JJ

ADS

Just a short note to say keep up the good work. I'm solidly behind you on your editorials and the format of 73 Magazine. One thing I would not like to see is a magazine cluttered with advertising like CQ and QST. In 73's case, I would rather pay a higher sub cost in the future than see more advertising in its pages.

W8WAT

We will try to keep the percentage of editorial to advertising high. The readers like it better and the advertisers receive better exposure.... Wayne.

A BUILDER

You have the best amateur radio magazine. Bar none. I have built many projects and gear using the info from your magazine. Biggest and most successful has been the frequency counter designed by K2OAW. It works like a charm. Now for the reason I am writing to you on the November issue's jacket. You will find a copy of page 57 of the November issue. You can see that part of it is missing. The printer must have goofed. Please send me a good copy as part of the K2OAW up date on his counter is missing. By the way, I have almost completed the "Selective Calling Device" on pages 51, 52, 53 and 54 of the October issue of 73.

C.E. Showalter W4UJL

MODEST PROPOSAL

While reading the letters in a back issue of 73 on the scre..., ah incentives given us by the ARRL, I think I've come up with a fantastic solution.

Here goes: First, find a capable and responsible person to take over the publishing of 73 and retire (temporarily). Now, since there are some 280,000 amateurs in the U.S., and only about 80,000 belong to the ARRL, I'm sure at least 160,000 must be left to support you. So all 160,000 of us join the ARRL! Horrors! But wait, with 2/3 of the membership backing you, we can fire Huntoon and elect you as General Manager of the ARRL.

Once you have become supreme dictator, ah, general manager, you can get some things done that amateur radio vitally needs such as:

1. Establish a Washington lobby! In this day and age of politics it is insanity not to have one.

2. With the Washington lobby to pressure, that is make suggestions to, the FCC, establish a hobbyclass license for 220 with a basic theory and regulations exam but no code.

3. Shake QST loose and make it a competitive, and then maybe progressive magazine.

4. Restructure the ARRL into a more responsible, more representitive, progressive organization able to reflect the needs of present day amateur radio.

Now that you've advanced amateur radio and the ARRL fifty years, you can step down and return to 73 and publishing one hell of a fine magazine. Or maybe stay and run QST, whichever, you can count on me for vote #1.

Kevin L. Johnson WBØFGO

The incredible intelligence of our readers never ceases to amaze me...Wayne.

DOUBLE STUB TUNING SYSTEM

WA6CPP's double-stub tuning system (November 74) can be simplified by bringing the 180° of transmission line around into a circle and using only one sliding short. This may sound weird, but the short reflects any wave that reaches it (because it's a perfect mismatch) so no energy can travel past it. The sections on each side of the short form independent shorted stubs. Naturally, a low-resistance connection is important, so the joints should be either soldered or clamped tightly and protected from corrosion.

Doing that much gets rid of the "ganged" adjustment, making the matching procedure much easier, with no walking back and forth. However, it has also been pointed out in the past that a couple of wavelengths of high swr line between the antenna and the matching device cause no particular harm. The reflected energy just bounces back and forth in the mismatched section until most of it radiates. This means that enough half-wavelengths of line can be placed between the antenna and the first stub to place the short point at the bottom of the support structure, making the adjustment possible from the ground, or at most, a step ladder. Radiation from the extra open line can be minimized by twisting the line with a fairly short pitch.

John A. Carroll

Caveat Emptor?

PRICE — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.
Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.
We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.
For $1 extra we can maintain a reply box for you.
We cannot check into each advertiser, so Caveat Emptor . . .

PORTSMOUTH RADIO CLUB requests help for Everett Reese WA8WIV completely burned out restaurant, home, all personal belongings. $60,000.00 loss and little insurance. Any financial help will be very much appreciated. Send all contributions to Portsmouth Radio Club c/o Trust Department, The Portsmouth Banking Company, P.O. Box 1151, Portsmouth, Ohio 45662.

STANDARD FM Equipment — Special huge discounts, 2M FM; 10 watt base/mobile SR-C 826MA $335 ppd. 2 watt handie talkie, SR-C 146A, crystals for 2 channels, $240. All brand new. Order now, write for catalog. Larger discounts on units of 3 or more. Bercom Electronics, P.O. Box 237, Bergenfield, NJ 07621.

WANTED: Make model and serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma Washington 98466.

COLLECTOR is interested in books, autographs and other information on early radiotelephone pioneers. Ronald Phillips, 1925 Baltimore, Kansas City, Missouri 64108. (816) 842-9009.

AMSAT/OSCAR 6-7 SLIDES — set of 5, $1.25 Lift-off and equipment Proceeds AMSAT. K6PGX P.O. Box 463, Pasadena, CA 91102.

WANTED: Hallicrafters SX-88 for parts, any condition considered. KØMNA, 4805 Sullivan, Wichita, Kansas. 67204.

STANDARD 146A — 3 months old, with 94/94, 34/94, 73/73, 25/85, 16/76, nicads, charger, rubber ducky and 2 whip antennae, external mike, 2 leather cases, $300.00. Mike Arseni, WA2WCB, 30-91 Crescent St., Astoria, New York 11102. (212) 626-7817, after 1800.

YOUR SWAP-N-SELL ads run free in TRADIO, a public service publication of Wichita Amateur Radio Society, Box 4391 Wichita Falls TX 76308.

FROM UNIVERSITY-Sound 4 C 15 W Woffers in unopened cartons. Retail $169 each. Will sell at $1.00 each. Write Cassette Headquarters, P.O. Box 482, Jaffrey, N.H.

NOW PAYING $2000.00 and up for ARC-94/618T, ARC-102/618T. $1200.00 and up for ARC-51BX. $1500.00 and up for 490T-1 antenna couplers. We also need these control boxes — C-6287/ARC-51BX, C-6476/ARC-51BX, C-714E-2. We also need R-1051 receivers, RT-662/Grc-106 transceivers. We buy all late aircraft and ground radio equipment. Also pack radios. We are buyers not talkers. Bring your equipment in, you are paid on the spot. Ship it in, you are paid within 24 hours. We pay all shipping charges. If you want the best price for your equipment, call us. Call collect if you have and want to sell or trade. We also sell. What do you needD&R Electronics, R.D. 1 Box 56, Milton PA 17847. Phone 717-742-4604. 9:00 AM-9:00 PM.

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding, literature Estes Engineering, 543-A West 184 Street, Gardena CA 90248.

FOR SALE: Drake TR4, AC4, DC 4 $495.00. Knud E. M. Keller, Rt 12A Surry NH 03431.

FACSIMILE recorder, Times RD92AUX120, CV172 converter, excellent cond. with book, paper, $175. K. Bassett, 1124 Woodrow Waynesboro, VA 22980.

GE-VOICE Commander II with crystals on 94, charger, battery, case, book, excellent cond. $55 each (2). K. Bassett 1124 Woodrow, Waynesboro, VA 22980.

TRADE: Collins 75S3-B, 32S-3, 312B-4, 516F-2, mint round emblem, for Bendix R-1051B or URC-35 transceiver, (RT-618/URC and AN-3007/URT). Sid Sidman, 3571 Gresham Ct., Pleasanton, CA 94566.

FREE: 12 Extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Yaesu, Kenwood, Swan, Atlas, Standard, Clegg, Icom, Hallicrafters, Tempo, Ten-Tec, Venus, Alpha, Hy-Gain, CushCraft, Mosley and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. (812) 894-2397.

WANTED: Tapetone converters for Model 345 Skysweep. Also NC 300 receiver. Bob Harmon, P.O. Box 751, Deming, New Mexico 88030.

GE PROGRESS Line portable on 94, internal charger, less battery, with book, $40. K. Bassett, 1124 Woodrow Waynesboro, VA 22980.

FREE: 12 Extra Crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Collins, Kenwood, Icom, Ten-Tec, Swan, Atlas, Alpha, Standard, Clegg, Genave, Tempo, Midland, Hy-Gain, Mosley, CushCraft, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute, Indiana 47802. (812) 894-2397.

TECH MANUALS — $6.50 each: R-220/URR, URM-25D, USM-159, USM-16, PRC-10. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

SIGNAL GENERATOR (measurements model 80) $200.00, also AC VTVM $20.00. Call 914 297-0557.

VERY INTERESTING! Next 5 big issues $1. "THE HAM TRADER," Sycamore, IL 60178. (Information about our "HAM EQUIPMENT BUYERS GUIDE" covering equipment 1945-75 included. Nostalgia! Helpful!)

. . . W2NSD from Page 3

stations, on television and in the newspapers – talking it up on CB and at CB clubs.

5. Get all the publicity you can for amateur radio via club activities such as providing communications for walkathons, car rallies, parades – and be sure your club PR man has the story and pictures for the media. If a club member does anything outstanding in amateur radio be sure the story is written up for the papers and mention the club meetings.

6. Organize club events and make sure every scrap of publicity is gained from them. Hamfests, picnics, auctions, banquets, Field Day, VHF Contest group effort, other contest efforts by the club – all are good for publicity, which is the name of the game.

7. Improve meetings so newcomers will continue to come. Ruthlessly eliminate business meetings and have them run by the executive committee with nothing more than a short report. Eliminate the unnecessary trivia such as treasurer's report, other reports that can be done without. Get right down to an interesting speaker – into a short tech talk – show and tell on some gear built by a member – slides of a DXpedition – QSL card showing of some rare ones – demo of RTTY – of slow scan – Fax – talk on Oscar – 160m action – DX news – moonbounce – VHF SSB action – be sure every club member who has done anything of note gets an opportunity to brag about it.

8. Keep the club newspaper or bulletin lively. Start controversy at meetings and ask anyone interested to comment in writing to the club bulletin. Have the editor get the Hotline and thus have some hot news for each issue of your bulletin. Keep members up to date on DX scores of your serious DXers – DX scores of SSTVers – or RTTYers – certificate count of certificate hunters – etc. Put all that bragging into print to encourage others to compete – and more fun will be had by all. The club paper can help organize club contest efforts.

9. Since one of the factors which is considered important by the FCC as justification for amateur radio is emergency service, it is prudent for clubs to do what can be done to organize the members to be ready for emergencies. Repeater clubs have an advantage in this since they have such outstanding communications between members. Clubs should appoint Emergency Liason Officers who will be in charge when needed. These men should have at their fingertips everything they might need to do their job such as phone numbers of all other radio services in their community (police, fire, sheriff, CAP, highway, doctors, trucks, public service, etc.). They would do well to be licensed in as many of these services as possible and be able to intercommunicate with them for emergency purposes. They should have an inventory of emergency equipment such as generators, HTs, portable repeaters, available club members with mobile rigs, etc.

Continued on Page 136

CAN ARRL BE PRODDED?

The fact is that your club can get some action from the ARRL. They may be insensitive to individuals, but you may be sure that they listen when a club has something to say.

1. Get to know your ARRL director. Get him to your club and don't just listen to him talk, but insist on answers to problems, local, national and international. He is *your* representative and he *must* know the answers. Make sure your director is informed of the will of your club and insist on getting an answer back from him as HQ's response to this.

2. Your club can do a lot to initiate PR on a local level, but national PR is needed too and this means the ARRL since there are *no* other organizations to do this. Your club can be very insistent that ARRL does something concrete about this such as working up a series of television spots which hams at TV stations can urge management to run as often as possible. Some of these can be keyed to local clubs. Some can offer a pamphlet put out by your club. The League has vast resources to get national publicity.

3. Your club should discuss all FCC dockets and rules you want changed — and see that members send in comments — that the club sends in its own comments — with copies to your director and feedback later from him as to HQ action in the matter. All club members should be well informed on all aspects of rules changes and should know where the ARRL stands on these items.

4. Since amateur radio hinges entirely on the International Telecommunications Union (ITU) in Geneva your club should know exactly what is being done by the ARRL to prepare for the proposed 1979 ITU Conference. You should insist on knowing what the League is doing with the $100,000 fund the directors set up to fight for amateur frequencies — and what they have done with it in the past — accept no double talk. Your money is involved and you have a right to know exactly what it has been, is, and will be used for. Obviously the results of the ITU Conference hinge on the attitude toward amateur radio of the so-called Third World nations. This means that your director should be reporting on the actions of HQ in contacting these countries and the results of these meetings. Perhaps your club can help with things like this by setting up a liaison with some small country and sending surplus equipment — callbooks — ham magazines and books. The League can set up these liaisons through your director. Be sure your club gets reports on what ITU nations are proposing for changes in the amateur bands — these proposals are made many months to years before the conference so delegations will be able to coordinate with each other. U.S. amateurs should be informed on what Germany, England, Australia, India and other countries are proposing to do with the amateur bands.

5. Since it is difficult for everyone to keep in touch with what is going on with the ARRL it might be prudent to have someone in your club appointed as an official liaison between the director and the club — someone who will take the time to read the fine print in QST — get the official bulletins — keep track of what the League is doing on various FCC dockets — of what they are doing with the ITU and contacts with other countries preparatory to the ITU conference — keep track of the quality of the representation of your division ARRL director — keep track of ARRL elections — and report at each club meeting what is going on — who is running for office and what their qualifications are — what has been or has not been happening at HQ — what response he has had from the director on club positions on dockets and other amateur matters — etc. This liaison should get the various ham newsletters, the ham magazines, and all mailings from the ARRL, including director letters.

...Wayne

GRR GRRREEN

Continued from Page 160

if they don't pay, just to prove that they can.

Since the editorial asked at the end if members want QST to continue with this practice, there is some suspicion that they might use a response from the readers as an excuse to change this policy.

One prominent mail order advertiser who claims that his QST ads have not pulled well at all was particularly furious. He wrote a blistering letter to us (he advertises very successfully in 73) pointing out that on page 166 of that very same issue of QST they ran an ad for Dycomm, so who did they think they were fooling with their sanctimonious act? He enclosed a review of the Dycomm amplifier from the Mid-Oklahoma Repeater Newsletter which said, "It has generally been conceded that the Dycomm Super D amplifier should be categorized as a Super Dud. In addition, you should learn to attempt to tune a Dycomm amplifier. One of the brightest technicians who works on commercial equipment every day undertook such an effort with the consequences that the final transistors blew out. This has been known to happen even if you weren't tuning the amplifier! Also, Dycomm must get their power ratings for their amplifiers from a Captain Marvel Comic book because they border in the realm of science fiction. A problem this editor had with a Dycomm amplifier ended with a couple of nice letters to the manufacturer explaining the problem over what apparently had been a mistake between the dealer that the amplifier was purchased from and the manufacturer. The amplifer was repaired (at a cost) and returned and a small note included saying that the problem was in the private dealings between me and the *amateur* I bought it from. Apparently Dycomm dealers are not dealers, but just people who pass this garbage to an unsuspecting amateur population and your only remedy would be to sue your friendly dealer. Objectively, some people have had success with this equipment and had few problems, but I have yet to see one that meets the power specifications advertised. You would do much better to buy a KLM or TPL or other. A threat of legal action brought a response from Jim Penhy (who seems to be the president, engineer, technician and shipping clerk) saying that he would exchange the amplifier for another for only $50 more! Should I throw good money after bad?"

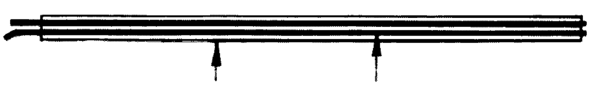
Just recently we received a good comment on a Dycomm repeater, so all is not a total loss. Our experience with Dycomm repeaters was extremely bad at 73 — and many of the repeater groups we talked with who had tried them were very disillusioned. It seems unlikely that QST has not had at least some of the letters of complaint on the Dycomm amplifiers — many have been received at 73 — yet QST continues to carry the Dycomm ads. Odd. But then they continue with the Trigger ads too, even after CQ published quite a terrible letter about Trigger.

...Wayne

John Boojamra W2BJB
55 Winthrop Street
Brooklyn NY 11225

QUICK CAP

Very small capacitors made from twisted hook-up wire are often not stable enough; one has to snip away until he hits the right capacity – he hopes. This gimmick uses a double fluted plastic coffee stirrer, into which #14 wire fits snugly to form the plates of a capacitor. When checked out on a General Radio Q-meter, it was found to be linear throughout: 1 pF per inch. Need a 3 pF capacitor? Just cut off 2" from one end!



. . . W2BJB

Voxpoop

A reader, who unfortunately did not give either his name or his call on his correspondence, has made the following excellent suggestions for additions to the content of 73:

A "This Happened to Me" series which could include humorous or serious stories of first contacts, unusual QSOs, weird experiences with equipment, both home brew and commercial, etc.

An updated listing of nets operating daily in the states and abroad.

An updated listing of VIP stations; amateurs famous in fields other than amateur radio as well as those considered "professional amateurs."

A simply written column covering new concepts and components.

Guest editorials by VIPs.

Anyone out there feel like taking on any of these projects? Remember, 73 pays for publishable material.

I like the magazine as is, but you won't be able to please everyone. Ha! WA6MBK. *(Boy, are you right on that one!. . .ed).* I would like to see more SSTV construction projects. The WØLMD converter article was excellent; continue along this line of quality — W7QNI. *(We will, we will. . .ed).* Keep up the off-beat articles like "Lightning in a bottle." The digital stuff is great too. Maybe an article someday on testing complex ICs such as RAMs, ROMs — Callas. You have a lot of good articles — keep sending them. Include more things a Novice can use in 73 — Tommy Richardson. Less articles on slow scan — W6NXB. *(Henry, you're sure swimming against the tide!. . .ed).* More digital please — Chris Leach. First thing read are NSD editorials. Tell OM to keep up the stomping. . .stomp on the ones who need it. . .stir up the things that need stirring up. Ham radio needs more NSDs — K7QYN. *(Troublemaker. . .ed).* More VHF-UHF projects. Regular column of hints for improving commercial equipment. More nude covers, they're great! — K8JBJ. *(Another troublemaker. . .ed).* Too much IRS and not enough ham radio — WA6UGH/3. *(Okay, you help get rid of the IRS and no one will have to write about the bastards. . .ed).* Would like to see a 2m dual synthesized IC constructed portable transceiver. . .if possible — Bill Hampton. W3HPX's Moskey is beautiful — gonna build one pronto. CMOS logic is definitely the way to build to conserve power, and prices are dropping on CMOS ICs — WA4MRE/Ø. On balance Wayne, the magazine is pretty good — you'll never be able to publish enough technical articles to suit me, but you're doing a fair job now. Keep up those editorials — W9EQG. More digital information and construction projects — when you put a project in it should be checked thoroughly to make sure all the information is given — WA1CRI. *(Oh, we try, we try. . .all articles are proofread by the authors now. . .two recent editors tried to skip that important part of the process and both are now looking for work in less exacting fields. . .ed).* You ought to include more 6m gear in the line of FM construction articles — WA6OIL/4. *(Love to. . .has anyone built anything like this recently?. . . ed)* Better yet, just double it. Two issues (one dollarette each) each month — R. Thomas. *(We've been thinking of that, but don't know how many would want it. . .ed).* How about a series on digital logic fundamentals to run for an indefinite period? This could be helpful to many hams so they can make use of contemporary construction articles — W1MKF. *(Fine idea. . . any takers?. . .ed).* I am disappointed that you do not give details about contests in 73 — C. Junck. *(We've been looking all over for a good contest editor, but haven't come up with anyone interested yet. . .pity. . . ed).* More 6m FM articles please — WB8QKR. *(Hey, is anyone on 6 these days?. . .ed).* Please — more construction projects and circuits on ATV (fast scan) — K3VUD. *(We're trying to get as much info into print as we can. . .any more articles available out there?. . .ed).* Congratulations — keep the construction projects coming — XE2OZ. Include a regular column on antennas and one on a critical review of new equipment — WN2VMG. How about something on the care and feeding of FEDs? — DA4AU. *(Like ground glass or cyanide?. . .ed).*

Like "Solid State" news approach as done by K8DIZ — W8ANJ. I feel you should be more consistent with your covers. Although I do like Schlitz, the December 73 cover was much more thrilling. Also, the more solid state the better — WB4ZXQ. I think you have a nice mix of articles and projects — WA7JLL/5. *The* best ham magazine on the market today. Pricewise also. Have been asked by many where I get some of my information and I tell them "in 73 Magazine." I give them a subscription blank if it doesn't ruin an article in the magazine. I don't like to get magazines with inserts every 16 pages. I still have all copies of 73 back to '65 — they'll make good reading in my old age — WAØWJK. *(I don't like those cards either, but they sure pay for a lot more pages in a magazine, if you happen to like a fat magazine. . . Wayne)* Would like to see more articles on counters, computers. The ICs become obsolete before articles reach print. I'm still trying to keep up with the 7400 series, which is impossible. Keep up the good work — W4GXS. Fire Wayne Green. He is a loud mouthed jerk who writes first and researches later on — WA6SLN. *(tsk, tsk. . .Wayne)* Vote for K8DIZ Solid State, and push for CW on HF for Techs — WA7DTJ. *(I have a petition with the FCC for just that — been there for years. . .Wayne)* For some reason you seem to have forgotten the six meter band — Russell, Ohio. *(While not much is doing on 6m of real news, you may have missed the 50 MHz column? Any readers want to push 6m? Be our guest. . .Wayne)* Use larger type, esp for repeater update. Cut space used by Green to one page. See Jim Fisk page — WA3VYS. *(Buy some glasses like I did and you'll read the print fine. If I had as little to say as Fisk I'd use no space at all. Oh, Fisk knows there are things he should write about, but I doubt if his publisher will let him — terror of being controversial. . .Wayne)* The editorials should be much longer — W7IDF. *(For fifteen years Ken has been an unflagging source of erudite and puckishly good humored letters, cards and articles — what a delight a reader like Ken Cole is to an editor with a mailbox full of gripes about ARRL sluggishness, DXCC rules, FCC insensitivity, subscriptions gone awry, and the other trivia which adds up to much of the usual day's work. Bless Ken and the few others like him who spread happiness. . .Wayne)* I would like more articles on building receivers for HF through 2m FM, plus test equipment such as an impedance meter — W5SQJ. *(Excellent, any takers? We'll print 'em. . .Wayne)* I like Circuits[3] and IC articles, especially CMOS — W6KKD. How about 6m SSB news? Maybe repeater news by call area? — WB4MXC. More 6m equipment, SSB xmtrs rcvrs, converters, linears, etc. Also would like to see construction articles monitor scopes for SSB, CW and RTTY. Let's get more 6m articles so we don't lose that band — WA4AGD. *(We agree. . . Wayne)* How about special columns for antennas, QRP, and perhaps articles on the fundamentals of RTTY and SSTV? — W8OUG. *(We've books out on the RTTY and SSTV fundamentals, plus thorough coverage in the past. Any interest in a monthly QRP report?. . .Wayne)* I think we are all with you re IRS rip-off. Bureaucratic power fears speech, so you must be made QRT. Look at any of the leaders of "The Movement." Good luck — W2RI. *(Thanks, Al, there is much in what you say . . . Wayne).*

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February

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ALASKA	14	7	7	3	3	3	3	3	7	7A	14	14A
ARGENTINA	14	7B	7B	7	7	7	14	14A	14A	14A	21	21
AUSTRALIA	14	7A	7B	7B	7B	7	7	7A	14	14	14	14A
CANAL ZONE	14	7	7	7	7	7	7A	14	14A	21	21	14A
ENGLAND	7	3A	3A	3	7	7	7A	14	14A	14	7A	7
HAWAII	14	7A	7	7	7	7	3A	7	7	14	21	14A
INDIA	7	7	7B	7B	7B	7B	7B	14	7A	7B	7B	7
JAPAN	14	7B	7B	7B	7	3A	7	7	7	7B	7B	14
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PHILIPPINES	14	7B	7B	7B	7B	3B	7	7	7	7B	7B	7B
PUERTO RICO	7	7	7	7	3	3	7A	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7B	7B	14	14A	21	21	14A	14
U. S. S. R.	7	7	3	3	7	7	7B	14	14	7B	7B	7
WEST COAST	14	7A	7	7	7	7	7	7A	14	14A	14A	14A

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ARGENTINA	14	7A	7B	7	7	7	7	14A	14A	14A	21	21
AUSTRALIA	21	14	7B	7B	7	7	7	7	7A	7A	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	14A	21	21	14A
ENGLAND	7	3A	3A	3	7	3	7	7A	14	14	7B	7
HAWAII	21	14	7	7	7	7	7	3A	7	14	21	21
INDIA	7	7	7B	7B	7B	7B	3B	7	7	7	7B	7B
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PHILIPPINES	14	14	7B	7B	3B	7B	3	7	7	7	7B	7B
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14	14
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U. S. S. R.	7	3	3	3	7	7	7	7	14	7B	7B	7B

WESTERN UNITED STATES TO:

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ARGENTINA	21	14	7B	7B	7	7	7	7B	14	14A	21	21
AUSTRALIA	21	21	14	7B	7	7	7	3A	7	7A	14	14
CANAL ZONE	14	14	7	7	7	7	7	7A	14A	21	21	21
ENGLAND	7	7	7	3	7	7	3	7B	14	14	7B	7B
HAWAII	21	14A	14	7	7	7	7	3A	7	14	21	21
INDIA	7	14	7B	3B	3B	3B	3B	7A	7	7	7	7
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MEXICO	14	7A	7	7	7	7	7	7	14	14	14A	14
PHILIPPINES	14A	14	7A	7B	3B	7B	7B	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14A	21	21	14A
SOUTH AFRICA	14	7	7	7	7B	7B	7B	7B	14	14A	14	14
U. S. S. R.	7	3	3	3	3	3A	3	7	7A	7	7B	7B
EAST COAST	14	7A	7	7	7	7	7	7A	14	14A	14A	14A

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

GRR GRRREEN

EMP! Are You Prepared?

The answer to that is a resounding NO! EMP . . . Electromagnetic Pulse generation by the explosion of a nuclear device (also known as an atom bomb) has not been given much publicity . . . and that is unfair, because it presents some problems almost as serious as the bomb itself. Why have only one worry if you can have two, right?

Since the nuclear tests were made several years ago, back when they were using tubes . . . before the advent of solid state electronic equipment, the seriousness of the EMP problem was not realized. Tubes, as you may recall if you are over thirty, can stand an awful lot of zap on their input with no long range bad effects. Transistors go to hell immediately when zapped.

It seems that when a nuclear bomb goes off in the atmosphere a lot of gamma rays are generated and interact with the air to generate a substantial magnetic field . . . something on the order of 10,000,000 volts per meter. This magnetic field is so strong that there is probably no feasible way of shielding electronic equipment against it. It will burn out any semiconductor, confuse logic circuits and wipe out core memories. Think what that will do to telephone service to amateur radio, and broadcast radio! About the only thing left running may be an ancient Gonset Communicator here and there . . . and some old Motorola tube gear.

Heretofore we thought all we had to worry about during a nuclear attack was the initial blast, the firestorm if the blast is set off in the air, and the radioactive fallout. We figured that if we made it through the initial holocast we could set up our ham rigs and start trying to pull things together again.

It probably is not a good idea to even bring up this difficulty with civil defense officials since, with a few exceptions (probably very few), the intellectual awareness of most of them will not be able to cope with this added problem. Amateurs asking about CD plans to cope with the firestorms which air exploded nuclear bombs bring on have been given the fish eye and henceforth ignored. It does seem likely that since this type of explosion creates the greatest destruction, that this can be expected should negotiations fail during some future crisis. Most antennas and all feedlines can be expected to vaporize from the heat . . . along with a lot of us chaps.

Frankly, considering the amount of logic and transistors being used in repeaters and other ham gear, this is apt to be a bit discouraging. Perhaps George Grammar was right a few years back when he advised us to forget about transistors and stick to tubes. The thought of all that stuff going blip and turning into monodes approaches the unthinkable.

But how much energy are we talking about here? Perhaps we can button up our gear a bit and keep it secure. Energy in this case is measured in Watt-seconds . . . the quantity is the Joule, which is one Watt consumed for one second. It takes about .00001 Joule to ruin most semiconductors and a memory erasure can take as little as .000000001 Joule! Okay? Now how about a thermonuclear bomb? How many Joules are we starting with? The book says we get about 1,000,000,000,000 Joules. Now how are we going to go about keeping out that kind of zonker? If you like powers of ten, you're trying to figure out how to cut 10^{12} Joules down to less than 10^{-5} Joules . . . a factor of 10^{17}. By the time you got something shielded enough and by-passed enough to keep out that order of magnitude you'd never get anything you wanted into it to use it.

Say, come to think of it, the Russians are still using tubes for most things. Let's hope they modernize quickly . . . we'll all feel better. Are the Chinese using tubes?

If we elect someone who thinks that a war will be the best solution to a recession, let's hope he picks on some small unaligned country. Come to think of it, after failing so miserably in trying to beat North Vietnam, perhaps we'd do well to try some other solution to our economic woes . . . like cutting expenditures.

MORSE CODE TAPES?

Sure enough, an immitator has come along with code cassettes. . .it was to be expected. In this case it is not an improvement.

If you don't mind a little sarcasm, you might consider the other code cassettes if you are really into learning the code and want to take a *long* time to do it. The system of teaching used on the other cassette is right out of the 1930's and guaranteed to take you from five to ten times as long to get up to speed as the 73 code course.

What is the difference? The 73 cassettes have two main things going for them. . .firstly, in one hour the average person can master the entire alphabet, the ten numerals and the needed punctuation with the 5 WPM beginners tape. This starts right out teaching the letters as words, using them, so you are able to copy code almost immediately. Secondly, and of extreme importance to anyone who wants to save a few dozen hours of practice getting over that cursed ten words per minute hump that other code courses set you up for. . .the 73 tapes start you right out with all characters being sent at 13 wpm. . .just the spacing is for 6 wpm. Thus you don't have to learn the code characters at 5 wpm, then again at 6, at 7, at 8 and so on as you do with all of the graduated speed code tapes. You learn each character just once and you've got it.

And what kind of code course takes you to 18 wpm when the Extra requires 20 wpm? The 73 cassettes run you at 21 wpm, giving you a good margin for error and panic. And they give you cypher instead of plain language, an added margin for error. . .so you can't memorize the tapes.

Which do you want. . .1930's code or 1970's? Remember that the 73 code courses are advertised ONLY in 73.

QST EDITORIAL

The November QST had an editorial that really got quite a few manufacturers uptight. The gist of it was that QST refuses to carry advertising for firms which put out shoddy merchandise and so, if you don't see an ad in QST, you'd better watch out. Some manufacturers got mad about this because quite a few of them have tried QST and been disappointed in the advertising results and now run their ads elsewhere – yet they feel that QST is putting on the screws and forcing them to run ads in QST, even

Continued on page 136.

73

MARCH 1975 ONE DOLLAR

amateur radio

BOOK SUPPLEMENT: LOG PERIODICS

Antenna Radiation Mystery?

40m Inverted Vee

Invisible Antennas

18" Allband Antenna

Double Inverted Vee

32 Antennas You Can Build!

GIANT SPECIAL ANTENNA ISSUE

73 amateur radio

#174 MARCH 1975

COVER: Drawing by Bill Morello. Article, page 97.

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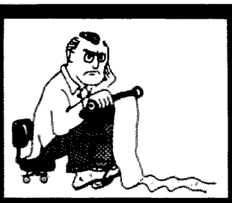
73 staff



...de W2NSD/1

EDITORIAL BY WAYNE GREEN

It is terribly unfair to point a finger at a group of amateurs and demand they feel guilty for not being pioneers . . .

KEYNOTE: GUILT

One benefit to me of publishing Hotline is the daily flow of club bulletins I receive in exchange for Hotline subscriptions. There are, I believe, well over a thousand coming in each month, and they make very interesting reading.

One of the bigger and better of these bulletins is Squelch Tales, put out by the San Diego Repeater Association. Beautiful job. In the December issue they reprinted the keynote speech of Armond Noble, the publisher of a West Coast ham newspaper, made at the San Diego ARRL Convention. (I seem to recall that someone else was supposed to be the speaker, but didn't make it, so Armond was pressed into service.)

The talk was too long to reprint here – it ran to over ten pages – but in essence it was an indictment of amateur radio. Armond went on at length, making his listeners feel guilty for being DXers, for working contests, for collecting certificates, for operating service nets, for not being builders, and so on. It was kind of a replay of an old Prose Walker talk, but without the part about how we should pity the poor CBers.

While there is some truth in what he said, Armond did not present the situation in perspective. He is right that few amateurs have done as much as they can toward coming up with new inventions and pioneering new techniques – though he does overlook many tremendously important things amateurs have done in this field. He gives us credit for opening short waves and stops there, ignoring the ham pioneering of FM, NBFM, SSB, SSTV, RTTY, etc., where ham work has been more than substantial.

It is true that not every amateur is an inventor or pioneer and it is unrealistic to expect it. It is terribly unfair to point a finger at a group of amateurs and demand they feel guilty for not being pioneers. Amateurs have done their share in this and, rather than feel guilty, every one of us should be damned proud to belong to a group that has done so much for our country and the world. Can you name any other group of hobbyists which has given the world as much?

Armond next points to DXers. Sure, a great many DX contacts are only seconds long and do absolutely nothing to enhance international good will. It may be that this aspect of amateur radio would be more productive if the QST Honor Roll were abandoned – though I am reasonably sure that the Honor Roll fills a gap and would be quickly replaced by some other group if it were cut – and instant DX contacts would continue to proliferate. Oddly enough, despite the pressure for short contacts, many meaningful conversations actually do take place on our bands and the cause of international good will is being taken care of.

The prospect of 100,000 American DXers lurking in wait for foreign amateurs to turn up on the bands so good will can be spread is not confidence inspiring. Never mind that a lot of the DX brethren don't spikka da Eengleesh too good and don't want anything more than a signal report and a QSL card. Never mind that the bands aren't big enough for more than a few long winded contacts at any one time and that one of the biggest blessings to band usage is that monster the pileup. A nice pileup can clean out a good part of the band.

The very nature of ham contacts makes it difficult to develop serious conversations. We spend years learning how to talk with people on a give and take (duplex) basis – with little if any practice on how to talk when you can't see or hear the other person while you are talking – and then, with no background, we get on the air and flounder around. The fact is that little work has been done on this problem – little has ever been published – little thought has gone into solving this difficulty.

When VOX came into use with the development of sideband, it looked as if we might be on the verge of solving this long standing misery. But no, amateur ingenuity quickly overcame the benefits of the VOX circuit and habit prevailed. At first we used errs to fill in the gaps to keep that VOX relay from kicking out — then we just turned it off. When is the last time you heard a VOX contact? So there we were, back to long winded (and often boring) pontifications or else hello-goodbye contacts.

Even if we were able to work out a duplex system of contacts, we would still have problems developing ways to get into meaningful conversations with strangers. If you've ever done the cocktail party circuit you know what I mean. The odds against getting into anything interesting in a conversation with a stranger are frightening. It is difficult to do.

The prospect of 100,000 American DXers lurking in wait for foreign amateurs to turn up on the bands so good will can be spread is not confidence inspiring . . .

There are probably many things that you know about or have done that I would enjoy hearing about during a contact. But how do I discover them and get out of the usual boring rut? Even after some 37 years on the bands I know as little about this as this years' Novice. Now and then a contact clicks and we both have a great time. Usually I get through talking with a few people and wonder why I wasted my time. This holds for all bands and all countries. I don't have much more luck in finding interesting contacts on two meters than I do on 20, DX or local. Note that I did not say anything about interesting people. I am sure that most of the people I contact are interesting, if only I knew how to get them primed.

When conditions are such that the best you can do is a signal report, then why not enjoy that — without guilt? It may be poor skip, interference from other stations, language incompatibility, a DXpedition situation where time is important, or pressure from others who "need" a QSL from the chap you are working — things like this are part of amateur radio and you make your short contact and move on. When you have a good solid contact and are able to get into something of interest to the two of you, have it and enjoy.

Is there any reason for self-flaggellation if we are guilty of not personally inventing SSB? Must we mope if we ourselves have not fostered international good will? Should we cringe if we have not handled traffic during a big disaster? Armond taps every reservoir of guilt in his keynote speech, going on to make us uncomfortable if we are only interested in one aspect of the hobby.

Amateur radio *is* a hobby. Those of us who are "serious" about it spend as much time as we can working with it. Some are into DXing, some into repeaters, some into moonbounce, Oscar contacts, DXpeditioning, SSTV, traffic handling, CD, rag chewing, certificate hunting, VHF contests, DX contests, club work, ARRL work, hamfests and conventions, putting out club bulletins, mobile DXing, mobile SSTV, and so it goes. There are dozens of fascinating hobbies all wrapped up in ham radio. Some even build (actually, an awful lot are building), and some invent. Obviously no one can do everything — at least not until there is a certificate out for it.

There is no way to work up a list of ham activities and assign priorities to them. Is international good will more important than Oscar contacts . . . than phone patches for Antarctic servicemen? It all depends on what your own bag happens to be at the time.

Armond puts down DXpeditions as pointless pursuits. Having been to Bat Guano Island twice for the purpose of giving out 5/9 reports, perhaps my own ox is being gored, but I can still remember the excitement we created on the bands as we worked through the pileups. We helped bring fun to thousands of amateurs all over the world. And *fun* is an integral part of amateur radio and living. Is something pointless because it does nothing more than create fun for thousands of people? If so, where does that leave television, radio broadcasting, theater, novels, etc. Fun is an important part of life and we pay a lot to those who help us enjoy living, even to the extent of donating money to hams foolish enough to go to Bat Guano Island and operate for a few days.

A nice pileup can clean out a good part of the band . . .

One other thing: I doubt if any of the thousands of amateurs who con-

Continued on page 137

HOTLINE HEADLINES

Summarized late-breakers for the active radio amateur.

ITU Crisis. FCC Commissioner Lee threatens possible U.S. walkout.

K7GCO Convicted. CQ Magazine antenna expert gets wrong number in fraud case brought by phone company.

Inverted Splits. Southern California has agreed to standardize on inverted pairs for splinter repeater channels.

Prose Goes. Reports that Walker will leave Amateur Division for BC post seem likely -- are denied by FCC.

Huntoon "retires." Replaced by Baldwin as General Manager ARRL and Editor QST.

Australia Doubles Fee. Up from $8 to about $16 now (U.S. dollars).

Fees Lowered in U.S. Down from $9 to $4. CB fees dropped, too.

CB Linears Banned. FCC action will ban single band amplifiers — should not affect amateurs.

A5 Magazine Renews. WB8HEE announces takeover of A5 ATV newsletter.

Crooks Caught. Detroit repeater used to zero in on holdup pair followed by 2m amateur.

CB Licenses High. Now coming in at rate of about 75,000 per month up 10,000 over last year — FCC fears impact of lowering license fee from $20 to $4.

Telemetry Problem. Amateurs must get special authority for telemetry of any kind.

Amsat Seeks Funds. $15,000 needed to fund Oscar 8.

Bicentennial Calls? FCC asks for suggestions for special prefixes for us.

FCC Okays Calculators. Now you can bring a calculator to the FCC exams.

Mexican Repeater. The Southern California Repeater Association managed to find a channel for a new Baja repeater.

CB Service Disrupted. Little old madam found soliciting Interstate biz by CB in Nebraska.

220 CB Hot Again. EIA, React and E. F. Johnson Co. just won't quit.

Fresno DX Meet. April 19-20 — Fred Laun — Darleen — others.

PA7 Prefix. Amsterdammers celebrate 700th anniversary with PA7 prefixes.

THE " SURPRISE " STORY

Voila a thumbnail sketch of a harrowing expedition by I2NSF/MM. 73 Magazine will be interested in getting further reports on this ambitious attempt to sail around the world single handed.

I2NSF/MM Ambrogio Fogar, in his yacht SURPRISE, left Italy November 5th, 1973. His aim was to sail around the world from East-West solo. He is probably the first Italian to attempt this voyage.

December 26th:
Arrived in Rio de Janeiro after an uneventful journey across the Atlantic Ocean.

January 2nd, 1974:
Left Rio for Cape Horn.

January 27th:
Rounded Cape Horn.

February 3rd:
Caught in a 90 mph storm 900 miles west of Chile, "Surprise" flipped upside down. All equipment ruined, daily contact with all amateurs ceased. ZL1BAK requested to give radio watch assistance and search and rescue alerted.

March 1st:
"Surprise" holed by playful whale. Emergency repairs to keep afloat.

April 9th:
Arrived in Auckland.

May 11th:
Left Auckland to travel south of Australia. New Swan SS200 transceiver and hustler antenna installed by ZL1AQE Des, and ZL1BAK. Ship repaired and restocked.

May 25th:
"Surprise" hit by worst storm around Australia, Ambrogio swept overboard on lifeline, "Surprise" capsized and Ambrogio able to reboard the "Surprise". All the equipment ruined again.

May 26th:
Ambrogio failed to keep daily schedule. ZL1BAK, VK4LZ, VK3OL, VK3UX, YJ8EE, VK3BH/aero mobile, maintained continuous watch, marine operations centre, Canberra, notified.

May 27th:
"Surprise" sighted heading for Sydney in good order.

June 5th:
Left Sydney heading south. Radio and antenna repaired by courtesy of Sydney VK's and A.W.A. Caught in storm, decided to sail north.

From then on, reasonable sailing conditions until the hazards of the Great Barrier Reef were encountered. From Torres Strait across the north of Australia, good weather gave the "Surprise" a good speed. July 21st, 2100 miles west of Australia. Assistance given by amateurs in New Zealand and Australia has been invaluable and contributed to the success of the voyage around Australia.

Reprinted from *Amateur Radio*, Journal of the Wireless Institute of Australia.

Bill Welsh W6DDB dressed up as Santa – a most apt costume for the chap who has helped over 20,000 amateurs get their tickets. Here Bill is working on 6-land DX QSL bureau records during time off between stints as Santa at a Lockheed Christmas party for kids.

ORIENTAL FM

Repeaters are not permitted in Japan. The main calling channel is 144.48 MHz.

After the contact is established, the operator moves to another working channel, although some operators QSO on the main channel, and cause a lot of grief to everyone.

The Japanese 2 metre band extends from 144 to 146 MHz.

A1 and F1 – 144.00-145.48
A2, A3, SSB – 144.10-145.48
F2, F3 – 144.32-145.48
JARL 2m beacon on 145.48
All modes 145.48 and above

All Japanese simplex FM channels are planned with a 40 kHz separation up to 145.44.

Australia – 50 kHz channeling
USA – 30 kHz channeling
Europe – 25 kHz channeling

Some clubs have so-called "private channels" between 145.48 and 146 MHz. These clubs have regularly scheduled Roll Calls; On Air Meetings; or "Gab Fests" on these channels. The Toyota Motor Club for instance meets on 145.62 MHz.

2m Japanese FM Channels

CH	1	144.36 MHz	*
	2	144.40	*
	3	144.44	*
	4	144.48 National Calling	
	5	144.52	
	6	144.56	
	7	144.60	*
	8	144.64	
	9	144.68	

10	144.72	*
11	144.76	
12	144.80	*
13	144.84	
14	144.88	
15	144.92	
16	144.96	
17	145.00	*
18	145.04	
19	145.08	
20	145.12	
21	145.16	
22	145.20	
23	145.24	
24	145.28	
25	145.32	
26	145.36	
27	145.40	
28	145.44	

F2 & F3 144.32 145.48 MHz
*Main Channels fitted.

JARL plan

FM IN HONG KONG

Japanese 2m FM simplex channels are used, mainly

Channel A 144.480 MHz
Channel B 144.600 MHz
Hong Kong has one repeater going.
144.480 MHz in
145.640 MHz out.

. . . George Francis VK3ASV

Reprinted from *Amateur Radio*, Journal of the Wireless Institute of Australia.

OSCAR 7

Interested in hearing the new AMSAT-OSCAR 7 satellite? Tune your receiver between 29.40 and 29.50 MHz (most any antenna will do), and listen for a "band opening" of 20 to 50 CW and SSB signals at any of the following times:

Friday, Mar. 7, 1975 from 8:45-9:05 pm EST and from 10:40-11:00 pm EST.

Sunday, Mar. 9, 1975 from 8:40-9:00 pm EST and from 10:35-10:55 pm EST.

(The second pass given for each date is good for the West Coast as well as the East Coast of the USA.)

Be sure to report your reception to AMSAT, P.O. Box 27, Washington, D.C. 20044, and you will receive one of the attractive new AMSAT-OSCAR 7 QSL cards.

Eye Emergency Network

HAM WHO HELPS HUMANITY

When Dick Colwell of Lubbock, Texas, positions himself before his amateur radio operator's console precisely at 6:45 A.M., it is not just to pass the day sending messages to other hams. Rather, he hopes to help a blind person see again.

As a member of the Eye Emergency Network, Mr. Colwell tunes into the network's frequency and jots down how many eyes are needed. After signing off, he calls the eye banks in his area. If the required eyes are available, he radios the network back.

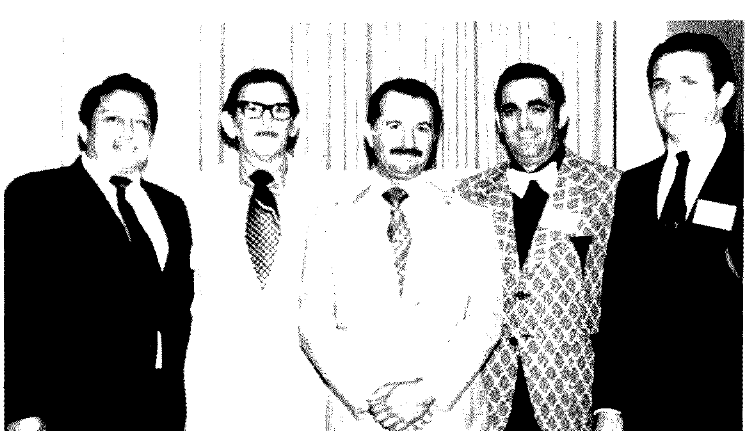
"The time I spend working the eye network is rewarding and exciting," Mr. Colwell says. "The network is made up of people from all vocations. Some are retired like myself, others still work."

Mr. Colwell's work isn't limited to the search for eyes. Any large-scale disaster glues him to his radio for long, exhausting hours. During Hurricane Hilda in 1964, he relayed hundreds of messages from the devastated area to distraught relatives who had spent anxious hours awaiting world of loved ones.

For his efforts during that catastrophic event, Mr. Colwell was awarded the American Relay League Public Service Award "in recognition of meritorious service in connection with Hurricane Hilda." The honor was just another feather in the cap of a man who thoroughly enjoys serving others.

. . . Mickia Mitchel

Reprinted from *Modern Maturity*, October-November, 1974. Submitted by William Barry.



Attending the SIRA new board of directors party at the Bacardi Bar in Miami, Florida we have left to right: Larry Lytle YN1LL, SIRA's Secretary; Ted Wayne WB4CBP, Vice-Director of the ARRL SE Division and President of the South Florida FM Association; Francisco Salar LU9AME, Honorable Consul of Argentina in Miami; Rafael M. Estevez WA4ZZG, SIRA's President & Coordinator; and Diego Lopez TI2DLM, Honorable Consul of Costa Rica in Miami.

BE MY GUEST

Visiting views from around the globe.

The Name of the Game

I had checked into the Maritime Mobile Service Net this past Sunday, October 14, as I often do. At 2145 GMT EL8C and I moved off the net frequency about 14.325 MHz and I ran a phone patch for him. We closed the patch at 2215 GMT and I was about to return to the net frequency when I heard TU2DP, Al, call me from somewhere in the Ivory Coast.

Al told me that his wife was quite sick and wanted to know if I could get a doctor that he could talk to. My XYL, Robin, was in the shack with me and she went to the telephone to call our doctor. Al's signal was 4–5 and I was worried that it was not going to be patch quality. But someone broke in (I didn't get his call) and told us that there were a couple of doctors in a net a few kHzs down the band. I asked him to get one of them to come up on our frequency.

Within two or three minutes we were joined by WBØDKK, Gordon, located near St. Louis MO. He and Al could not copy each other so I remained on frequency to act as relay, copying Gordon off the back of the beam.

Al's wife had been suffering from severe abdominal pains for the past week. Her pains were due to a gynecological problem. Al wanted to know whether he should transport a considerable distance to an American hospital or whether his wife's problem would subside of its own accord.

Gordon informed us that he was a gynecologist (some luck!) and started asking questions about history and symptoms. I relayed the questions to Al; relayed the answers to Gordon, which elicited more questions and more replies. This went on for about 40 minutes at which time Gordon advised Al to get his wife to the hospital as soon as possible – from what he had heard he felt that an operation would be necessary and should not be delayed any longer. About this time, we were joined by WA7RPR, Eldon, in Portland OR who is also a doctor and had listened throughout the QSO. He concurred with Gordon's opinion. At one point, I lost copy on Gordon, so his comments were relayed to me by Eldon and then relayed by me to Al.

After everyone was satisfied that all pertinent information had been exchanged, we ended our contact at 2258 GMT. I continued to monitor the frequency for awhile and heard EL3DN call TU2DP to tell Al that he had heard the whole thing and had patched the QSO to a doctor at a nearby hospital who also agreed with Gordon's diagnosis and recommendations.

The next time someone asks you what hams do and don't they get tired of talking about their rigs, tell them that the name of the game is service, both to fellow hams and to the public. The story just related is certainly not an unusual one in the annals of amateur radio, but it is really a moment of human drama in the lives of those who participate in it and perhaps makes one small addition to the outstanding tradition of amateur radio.

. . . Norm Kushnick WA3BPC

Anatomy of a Public Service Event

Local civic agency wants communications for fund-raising event (bike-a-thon, walk-a-thon, etc.). They ask for ham radio.

"Great," you exclaim . . . what with most everyone having two meters and the availability of a repeater, we'll give them a dazzling performance.

Someone assumes chairmanship (or delegated to club VP, etc.) and starts to call people to help. X-amount of souls will be vacationing . . . Y-amount will have to work . . . Z-amount will call you back and let you know. (If there's nothing better to do, they will grudgingly say yes.) You already have a list of definites (the few that you can always count on to drop whatever they're doing and help).

D-Day minus 1: Two or three of committed group call to say they can't make it. (Work, etc.) Borrow their rig, you ask? (It's part of the planned coverage.) They'd rather not . . .

D-Day arrives. You are not sure everyone is going to make it because of the constant changing of plans. Somehow communications come off surprisingly well, but with some flaws. (It's never perfect.) You look good to the civic group because you "snow" them in areas of lack. In any case, radio works well enough to let the civic group know that their planning did not meet their own criteria. All ends well! Radio gets good publicity . . .

Let's examine a few of the areas in which some light should be shed.

First of all, you are not doing the chairman a big favor by agreeing to help. You are doing ham radio and yourself a big favor.

Second, the chairman doesn't have 24 hours a day to devote to the planning and execution of an event for which he gets nothing in the way of recompense. He only has part of his spare time to devote to it, and if he is half as busy as you say you are, do you understand why he may get impatient sometimes?

Some remedies: When you call at the last minute to say you can't make it, please tell the chairman that you have recruited so-and-so to take your place. This is the least you can do, since the chairman had you scheduled for checkpoint duty and has no one to substitute.

If you can recruit no one to take your place, don't say "nothing doing" when asked to donate your rig for a few hours. (Remember, it was already figured in the plans.) Could be he can find a newcomer or non-2-meter type to take your place.

Public service events may seem like trivia to you, but they are important

to their sponsors (Mental Health, Cancer, etc.). Certainly the SET, Field Day and other drills are important, but in a public service event, you are helping people DIRECTLY, and in a REAL situation. They appreciate it . . . they cannot thank you enough . . . they give you much local publicity. This is what the public remembers. After all, isn't that what it's all about . . . people helping people?

Please remember, then, whenever you are next called upon . . . BE A SOLUTION TO THE PROBLEM, not part of it.

P.S. If the shoe fits, wear it.

. . . Anonymous

Reprinted from the Central Ohio AREC Bulletin.

Guest Editorial: Footnote

Tie A HEMAC Around the Old Magnolia Tree

The January 1975 issue of 73 carried a guest editorial about U.S. Army experiments in the use of live trees and live persons as "antennas". We subsequently received calls here at 73 (from Al Wolff WB2NTL and others) expressing concern over possible ill effects radiation hazard-wise or otherwise to the subjects, vegetable or animal, as they might happen to be.

We telephoned Dr. Kurt Ikrath, director of the HEMAC experiments at Fort Monmouth, and received some enlightening comments on the matter.

Dr. Ikrath said that most of the Army work has been done at high frequencies with power levels in the neighborhood of 10 to 20 watts, and at times even up to 100 watts, with never an observed "burn" or other ill effect to any tree. Of course, he said, their operations have been intermittent and not on a continuous duty basis.

As for use of a live human being as the antenna subject, again at high frequencies, the hazard potential was deemed to be negligible, if power levels were not in excess of one watt.

Dr. Ikrath observed that the toroidal loop in this HEMAC procedure is inductively rather than "galvanically" coupled to the living body, and that the living tissue is actually subjected only to an inductive field. He noted that human beings at a large airport, where much rf radiation is occurring, are subjected to considerably more stress from inductive fields than would be a person participating as a "person" antenna in HEMAC experiments.

One caution: The hazard goes up as the frequency goes up, so let that be a word to the wise if you are a VHF or higher nut.

So we are moved to comment finally that, if you have ever been tempted to put a little life into your wife's favorite magnolia tree by firing it up on 20 meters, you may feel perfectly free to go ahead, being assured that there will follow no ill or fatal effects to the tree, nor subsequently to you.

As our January commentary on the use of antenna persons had indicated, coupling to the belly is not recommended. We neglected to ask Dr. Ikrath about this, so the reason for the precaution is not clear. It is possible that it may be simply a division of labor among the military services, with the Army working in certain restricted anatomical areas, while leaving navel operations to the Navy.

. . . .Alex Barvicks WB4RVH
Technical Editor

Stuck on Two Meters?

I recently had the somewhat interesting experience of being indirectly called a "greenhorn" by an enthusiastic, but relatively new amateur. The explanation for this seems to be the fact that I frequent two meters, and of course, everyone knows, don't they, that only Technicians hang out there. Well, I must confess, that I don't hold the Extra Class license yet. However, I hope to someday. I do hold the Advanced Class ticket and I've been a licensed amateur for over 15 years. Additionally, I hold a 2nd Class Radio-Telephone Commercial license. I certainly do not claim to be an expert in any sense of the word, but I'm hardly a newcomer to the hobby either. I'm no stranger to the low bands and quite regularly fire up the Yaesu on 20 and 10 SSB and, yes, believe it or not, manage to work a fair amount of DX in spite of my obvious inferiority due to the fact I am a VHF enthusiast as well.

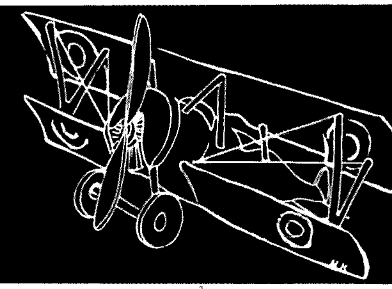
The point I am trying to convey is that many of us on VHF, actually a fairly large percentage, are General Class amateurs or higher and enjoy other facets of the hobby as well as VHF. Most of us work two meters because we enjoy it, not because we are stuck there! I still believe that two meter FM and repeaters are the greatest things to hit amateur radio since the Marconi Coherer! Much more technical ability has been displayed by two meter enthusiasts in building up some of the most complicated and sophisticated communications systems around. The vast majority of appliance operators who frequent the low bands would be hard pressed to equal these accomplishments. Amateur radio is a lot more than going out and buying a radio and an antenna and then calling yourself a communications expert as many of our eleven meter friends seem to do.

It seems to me that many of the dyed-in-the-wool dc boys would do well to take a second look at what is happening on two meters FM and VHF in general and possible re-assess their judgment of those who are "stuck" on two meters.

. . .K9UBF

Reprinted from *WRGABN*, Allen Co. Amateur Radio Tech. Society, Ft. Wayne, Indiana.

Autobiography of an Ancient Aviator



W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230

MARKING TIME

In last month's column I told about my good fortune in passing the Air Service Cadet Selection Board and the physical examination for flying. That was late in March 1920. The class for which my name was entered didn't start until September 1921 – almost a year and a half wait. I filled this time with various jobs from selling kitchen gas ranges to working as an inspector for the Lawrence Aircraft Engine Co. in New York. During this time I also met my wife-to-be, Cleo Willson.

When August 1921 rolled around, having had no word from the Air Service, I went to Washington to make sure all was well with my appointment to their flying school. I got an old friend of mine who was then director of the U.S. Coast and Geodetic Survey to make an appointment for me with Brig. General Billy Mitchell who was Assistant Chief of the Air Service. I had an interesting half hour with the general during which he had one of his aides check the status of my appointment. I asked him about the types of planes then being used for training. He said that, since no funds had been made available for newer types, they had upgraded the old WWI OX5 Jennies by installing 180 HP Wright Hispano-Suiza engines in them. These were used for primary training and WWI DeHaviland DH 4B planes with 400 HP Liberty engines for advanced bombardment and observation training and also for most routine flying. WWI SW5s and Spads were used for pursuit training. The general complained that the army seemed to think that flying was a passing fad, that it was not worth spending money on, while he considered flying of major importance, an attitude which got him into considerable trouble later on.

The general's aide returned and reported that I was indeed assigned to the Flying Cadet class scheduled to start September 15th at Carlstrom Field, Arcadia, Florida. The general mentioned that I would have a good *flying* commanding officer at Carlstrom in the person of Major Ralph Royce. Since I was going back to Littleton, N.H., I was advised to enlist as a Flying Cadet at Fort Ethan Allen, Vermont (near Burlington) and a letter authorizing this enlistment was sent to the commanding officer at that post.

Back in Littleton I got my things in order and, since I expected the class to take more than a year, I asked Cleo to marry me and come along to Florida. So we were married August 25, 1921 and had about a week honeymoon at Patridge Lake (near Littleton). Then I went over to Fort Ethan Allen and enlisted and got my travel orders to Arcadia, Florida. Since orders from Washington to the C.O. Fort Ethan Allen said nothing about transportation for any family, I had to pay Cleo's fare to Arcadia.

We arrived at Arcadia the afternoon of September 12th and checked in at the only hotel. It was a hot afternoon and we were pretty dirty after our long train trip so, without question, a nice bath was top priority. There was no shower so I turned on the water in our bath tub. In a few minutes the sickening rotton egg odor of sulphur water filled the room. How could washing in such water get you clean? You'd just be trading one bad odor for another.

Next morning I rode the six miles to Carlstrom Field on the railroad the town of Arcadia built on the level "Big Prairie" in a few days early in 1918. The military business of reporting to the post commanding officer, assignment to the Cadet Detachment and reporting to the Detachment C.O. took most of the morning. In the afternoon I passed a very thorough 64 examination (for flying) without difficulty. The fact that I was married caused a bit of a flurry. There were no married quarters on the post so we would have to live in Arcadia and I would commute on the "Florida Special" (train) leaving Arcadia at 6:30 am and returning after retreat (end of day's work). Since I would be having only the noon meal at the Detachment mess I arranged to have two thirds of my mess allowance ($1 per day) issued to me in kind (canned and fresh food). I also tried to get a Commutation of Quarters to help out on my rent in Arcadia. However, since the rank of Flying Cadet seemed to float somewhere between enlisted men and officers, they could find nothing in the regulations that would permit such a payment. Flying Cadet pay at that time was $75 per month.

Since my morning arrival at Carlstrom was at about 6:50 am I missed the reveille health class (calisthenics) as well as first mess. The cook, however, always had a cup of coffee and a bun or so for me. While I was having my coffee the rest of the class was in barracks cleaning, making up bunks and standing the daily inspection by the detachment C.O. Then, during the early part of the training, they all had to turn out for military drill. Because of my wartime experience as an Infantry officer I was detailed to perfect the class in close order drill and the manual of arms. Of course no one could see the importance of or reason for this drill. I explained to them that, since the Air Service was part of the Army its units had to be trained to at least not fall all over themselves when executing "squads right" in case of an inspection by high brass and that the sooner they got the hang of it the sooner they could go back to their bunks. In two weeks they were proficient enough for a 2 star general's inspection. The manual of arms drill proficiency was so low that I got the C.O. to forget about it and send the rifles back to the warehouse.

Primary Ground School started September 25th. It consisted of 24 subjects and took some 460 instruction hours plus examination time. The usual Army subjects such as Infantry drill, Army Regulations, property accounting, military law, paper work and interior guard duty were covered first (stuff every Army commissioned officer should know). Then aeronautical subjects such as aerodynamics, engines, propellers, rigging, meteorology, instruments, aeronautical navigation, radio and code were covered in some detail. Then the various machine guns and synchronizing gears (to shoot through propeller blades) followed. These were morning and afternoon classes until flight instruction began on November 15th. Then flying in the morning and school in the afternoon.

The ground school courses were quite thorough and the instructors well qualified. It was no tea party.

They had a board of officers nicknamed the "benzine board" that checked the record of each student after each examination and if any failed the examination or gave any other cause for disqualification he was immediately "BENZINED" (discharged). As a matter of fact our class started with 72 cadets and only 21 graduated (29%) from the advanced flying school. Two cadets from my class and a cadet from the class following ours "Went West" in a DH crash near Brooks Field, Texas on June 28, 1922. It seems that Cadets Farrell and McCoy, two of the best rated pilots of our class, had flown from Kelly Field over to nearby Brooks Field early in the afternoon of June 28th. When they were ready to return to Kelly Field, Cadet Thompson, who had just arrived from Carlstrom Field a few hours earlier and was on his way to report for advanced training at Kelly Field, asked them to give him a lift to Kelly. Farrell and McCoy agreed so all three climbed into the DH, Farrell in the front cockpit piloting and McCoy and Thompson in the rear cockpit (made for one passenger) for the ten minute hop to Kelly. They took off at about 5 pm and had only gained about 200 feet altitude when the ship suddenly spun in and burned. All three died. The consensus of barracks guesses was that, since most of Farrell's recent flying had been in single seater SE5s, he may not have been as familiar with the eccentricities of DHs as he would have been if he had had a lot of recent time in them. It was quite evident that he tried to pull up too fast after take-off with an extra heavy load in the rear cockpit – and the DH had said "NO".

Next month I will tell you about keeping Jenny seat cushions warm.

AMSAT NEWS

Joe Kasser

Two spacecraft are up and working. AMSAT-OSCAR 6 continues on its normal schedule, being available on Sunday mornings for descending node passes, and on Monday, Thursday and Saturday for ascending node passes. AMSAT-OSCAR 7 is available for use every day except for Wednesday. Note that all these times are CUT, which means that an ascending node pass on Monday really takes place on Sunday evening Eastern Standard Time.

Now that AMSAT-OSCAR 7 is up every one has a spacecraft to use on a regular basis, so stations that found AMSAT-OSCAR 6 too unreliable for them, due to the unavailability of Command stations, can and are dusting off their equipment and working through the new satellite. AMSAT-OSCAR 7 carries two repeaters, the 2/10 (as in AMSAT-OSCAR 6) is on for use on ODD days of the year, where Day 1 is January the first and so on, while the 70/2 repeater is available for use on EVEN days. Note that Wednesdays (CUT) are reserved for bulletins and experiments.

It seems to be the general impression that AO-7 is less sensitive on the 2/10 than AO-6. The cause of this phenomenon has not yet been defined but may be due to one or more of the following: Receiver (on the spacecraft) sensitivity; spacecraft tumbling; or just that the agc is doing its job, being affected by the high power boys and shutting the weaker ones out. Larry VE3QB has worked through both satellites using an IC-22 and a dipole, keying the rig by means of the push-to-talk button on the mike. He says that the mike is just the right shape for use as a key, but cautions silence when using that set up. "A sneeze does wonderful things to your carrier."

As for who is on the satellites, G3IOR writes about the following contacts in Oscar News: The best DX seems to be the contact between G8AWS and W6ZVV. Other stations heard in Europe are K1PXE, WØPHD, WØLER, K2LGJ, UG6AD, UR2EQ, K2KNV, LX1DB, HG5AIR, HG5KEB, WA1NGR, OE1WW, FC6ABP, LZ1FO, WA2RDE, W5HN, EA4AO, JA8RS, I1TEX, I5TDJ, ON4DY, DK2ZF and KL7MF. In fact G3IOR has worked 50 countries through the OSCARs. Although recommended modes of operation are SSB and CW a lot of work has been done on other modes. SSTV, RTTY and Fax have been sent through the spacecraft with good copy at the receiving end.

G3COJ writes in to tell about his first month's operation on mode B. He writes . . . "The main impression is of a vast number of DL and F stations, a few G, PA, I and OK and one station from each of the remaining countries. Good signals from USA and Canada, especially passes between 2300 and 2330 GMT which are out of range for continental Europe – cuts down the QRM tremendously. . . .The repeater seems to work well and I have fair signals back at times with NINE Watts erp, though I have not had QSOs with less than 45 Watts. Other times 100 Watts output has given a very weak return, especially with K2UYH, DL3YBA, EA4AO, F9FT or F6CJL on." Even so COJ has worked 24 countries including VE2, VE4, W1, W2, W3, W4, W8 and WØ.

From another part of the world KL7MF writes, "When it goes out over Siberia I get a beautiful signal (back), but nobody to work out that way. Hi! Do work an occasional USSR station out that way like RA9MBN."

RTTY telemetry is being transmitted by OSCAR 7 on two meters using space only keying. This is not the afsk signal that has been previously publicized but is another normal but previously unpublicized mode of operation. A modification to the ST-5 was described in the AMSAT Newsletter, December 1974, to enable it to copy the RTTY telemetry. There will be no need for most people to go to the lengths that G3JZK did to copy it. He played his receiver into an electrocardiograph recorder and then proceeded to decipher it manually. He sent in a sample and the readout, and his method does work.

Some frequencies to listen out on are:

29.510/475 SSB YV1AQE
29.495 SSB LX1SI
29.475 KP4DPN
29.475 ZE1DX

Coming up are ZD8PL, TU2VF, HV3SJ, and M1C. These may very well be on the air by the time that you read this. Sorry to say that VP9YC was a pirate as that call has not been issued by the Bermuda authorities. Either that, or someone's CW needs refreshing!

. . .G3ZCZ

FCC NEWS

The following is an excerpt from the Chairman's Report in the SCRA Bulletin.

Covert Rule Changes By The FCC?

One of the primary justifications the Commission has used in some of their more repressive interpretations has been the logical separation of the "control" and "operate" functions as they relate to an amateur radio station. They have said that to control is not to operate and, most importantly, to operate is not to control. This has been their rationale for requiring that a licensed Control Station do nothing more than effect the control of its associated remotely controlled station and that to operate, i.e., communicate, through it a separate Auxiliary Link station must be used. This is in spite of the fact that Section 97.108(a) stated "An amateur radio station may be *operated* by remote control . . . from an authorized *control* point . . ." (emphasis supplied). Since this section appears to directly refute their interpretations, it was probably considered to be a source of possible future embarrassment to them. In what appeared to be an attempt to preclude this from happening, on Tuesday, 11 June 1974, under the guise of a ". . minor editorial revision . .", this section, 97.108(a) was changed to read "An amateur radio station may be remotely *controlled* . . . from an authorized *control* point . . ." (emphasis supplied). In other words, where before we could *operate* a station from its control point, now we may do nothing more than *control* it; where before this section contained a very reasonable and logical restriction, its level of restrictedness has been increased to an excessive and unjustified degree. This change, this "minor editorial revision," has effected the removal of a significant amateur privilege.

What this change means to you is that if you have ever used your systems control channel/station to override the input channel and to communicate directly via the output channel, you can no longer do this. No more control station overrides to make announcements; no more control station break-ins to explain system procedures to a newcomer; no more control station communications, *PERIOD!* I used the term "covert" previously because the FCC made this rule change without a formal Notice of Proposed Rulemaking or Docket procedure, but rather under the heading of a *minor* editorial revision. In so doing, they prevented us from making any comments or arguments against it and were able to effect the change with almost zero publicity.

I am currently working directly with ARRL General Counsel Booth to see if we have any recourse to this change since it appears to be contrary to the Administrative Procedure and Judicial Review provision of 5 U.S.C. 553. Be advised, however, that getting it changed back could get a bit hairy; the FCC can't very well require a formal petition to reverse a change they made without the benefit of formal rule change procedures, but then how do you go about convincing them to change back something which they must publicly defend as being the same in content as the original?

A "Ringer" In The Crossbanding Docket

FCC Docket 20113, the "Crossbanding Docket", proposes the addition of a new Section 97.126 and describes it in Paragraph 7 of that Docket. This new section, as it is being proposed, is as follows:

> "97.126 Retransmitting radio signals. No amateur radio station, except a properly licensed repeater station, auxiliary link station, or a remotely controlled station in a system with an auxiliary link station, may automatically retransmit the radio signals of other amateur radio stations."

In my opinion, there are three major items of concern embodied within this proposed section:

1. **Complete lack of justification.** The only thing resembling an attempt at justification is within Paragraph Seven where the statement is made that ". . New Sec. 97.126 . . . would incorporate the *current policy* on other types of retransmissions." (emphasis supplied). Apparently the FCC feels that whatever policies are generated internally within the Commission are sufficient, in and of themselves, to justify a formal change in the Rules and Regulations. I don't know just how accurately I am able to read between the lines, but I get the impression that what they are trying to say is that they have been engaging in practices that, if they are not contrary to the Rules, are at least not mandated by them. This proposed new Section would not only legitimise these past practices, but justify their future use. Like most people, I am not concerned with the justification they use to effect de-regulation, but I am concerned with allowing them to set the precedent of "Regulate now, put it in the rules later." I respect the FCC, but not that much!

2. **Unnecessarily restrictive.** Even though the proposed section refers to the practice of ". . *automatically* retransmit(ting). . ", the narrative within Paragraph Seven states ". . An example of a prohibited practice would be the *retransmission* on the 14.0-14.35 MHz amateur band of another amateur station transmitting on the 144-148 MHz band, *or vice versa.*" (emphasis supplied). Note that within their example, no mention is made of the prohibited retransmission being "automatic". In fact, their own definition of "automatic retransmit" is ". . (the) retransmitting (of) other signals in real time or very near real time." In other words, it is the very fact that the retransmission is in ". . real time or very near real time . . ", and not the fact that it was effected by automatic means, that places the practice within the domain of this proposed new section. This would then place the received transmissions of other amateur radio stations in the same category as music; their appearance within the content of an amateur transmission would render that transmission in violation of the Rules and Regulations. Personally, I fail to see the necessity, nor even the desirability, of adding these new restrictions to an already overly-restrictive Part 97.

3. **Detrimental to remote base interests.** A very large number of SCRA members are also heavily involved in Remote Base operation and this proposed new section is aimed directly at them. As most of us know, probably the biggest single stumbling block to the proper licensing of most Remote Bases is the FCC's interpretation that the communications audio, both to and from a remote, must be transmitted via an Auxiliary Link station. Most remotely controlled

Continued on page 12

FCC from page 10

repeaters are also hamstrung by this same interpretation. Of interest here is the fact that the FCC has not stated exactly which section of the Rules and Regulations they were interpreting. It is the belief of many that there is no such section; that they have established a baseless interpretation for the purpose of making illegal that which Section 97.109(b) specifically permits. (97.109(b) states that a remotely controlled station may be operated from its authorized control station(s), be those stations fixed, portable or mobile.) The point that I am trying to make here is that, as far as I know, there is no current basis within the Rules and Regulations for their prohibitive interpretations. One of my primary fears is that this proposed Section 97.126, if allowed to become a part of the Rules and Regulations, will become their basis for these interpretations. Notice the wording of the proposed section. For a remotely controlled non-repeater station to be "legal," it must be " . . in a system with an auxiliary link station . . . " Now here would be a section that nobody could question the interpretation of; this would create an almost unbreakable bond between Remote Bases and auxiliary links, making the former virtually unlicensable without the latter.

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FCC REGULATION

While cleaning out the garage I came across some old FCC rules in effect in 1956. Rather than consign them to the trash, I keep these in a special binder — it's sort of fun to look through them and remember "the good old days" when life was a bit simpler and taxes were lower. (We are now in the "good old days" that we will be talking about in the future.) Many things were simpler than they are now, according to the old rules, but many things are better now than they were then, with the possibility of getting better.

In the amateur rules, we have more use on 160, and expanded phone privileges. The broadcast rules no longer require repetitious announcements that music is recorded (mechanically reproduced). Holders of radiotelephone third-class permits can operate more complex stations now than before.

1956 - 1975 Comparison

Part	1956 Pages	1956 Price	1975 Pages	1975 Price
Frequency Allocations and Treaty Matters	33	$.25	139	$8.00
Radio Broadcast Services	96	*	466	18.50
Amateur Radio Service	20	.15	72	3.50
Commercial Radio Operators	7	.15	?	8.00

*The price is not stated.

The most striking change is noted in the size, along with the associated price of the documents. Admittedly, the print is a bit larger and subscribers to the rules receive convenient supplements consisting of corrected and additional pages (usually issued quite late — the amateur rules regarding log changes have yet to arrive).

Each of these parts now comes with several other parts — the government combined the individual parts into groups some time ago in an effort to save money(!). The amateur service also contains rules for the disaster communications service and the citizens' radio service. (Whooppee! The subscriber can peruse the citizen band rules at his leisure to see that there are in fact rules for this service which apparently are not enforced by the commission — perhaps they don't know about them.) The radio broadcast service also contains auxiliary broadcast rules, involving remote pickup, experimental, developmental, CATV rules, and the like.

In 19 years, the allocation information has increased in price 32 times; the amateur rules have increased 23.33 times. It would appear that the government, while talking a lot about fighting inflation, does little about it.

. . .WA6CPP/WA7PEI

The Australian Exam

Amateurs working to pass the FCC exams may be interested in how it is for their compatriots down under. How would you do on these?

SECTION M (Theory)
(Time allowed — 2½ hours)
Note: SEVEN questions only to be attempted. Credit will not be given for more than SEVEN answers. All questions carry equal marks.

1(a) With the aid of a block diagram describe the operation of each stage of a single-sideband suppressed-carrier transmitter.

(b) Explain how the transmitted sideband may be changed from upper to lower sideband.

2(a) Assisted by a circuit diagram describe a variable-frequency oscillator (V.F.O.) suitable for use in the 7 MHz amateur band.

(b) With reference to a V.F.O., discuss the factors upon which the stability of the generated frequency depends.

3 The antenna coupling network of an amateur transmitter is designed to match an antenna whose impedance lies between 50 and 80 ohms. Assisted by a diagram, describe an antenna which will meet this requirement on at least two amateur bands. Show dimensions and state the frequencies involved.

4(a) With reference to a radio-frequency amplifier stage, explain under what circumstances neutralisation is necessary.

(b) Aided by a circuit diagram, explain the theory of one method of neutralising a single-ended output stage.

(c) Explain why it is necessary to neutralise a frequency multiplying stage of a transmitter.

5(a) Describe the manner by which high-frequency radio waves may be propagated over long distances. Explain why communication between countries such as America and Australia is restricted to certain times in the H.F. bands.

(b) Explain why communication over long distances as described in (a) is not possible using the V.H.F. and U.H.F. amateur bands.

6(a) Discuss features you consider desirable in a microphone which is to be used in a mobile capacity.

(b) With the aid of a sketch describe the construction and theory

of operation of a microphone which you consider meets these requirements.

7(a) With the aid of a sketch show the construction of a cathrode-ray-tube and explain the theory of operation.

(b) Show a method of connecting a cathode-ray-oscilloscope to a telephony transmitter to indicate its depth of modulation.

(c) Sketch the pattern obtained when using the connections shown in (b) if the carrier is modulated to a depth of 100%.

8 In relation to a communications receiver explain what is meant by the following terms: (i) signal-to-noise ratio, (ii) selectivity; (iii) image rejection; (iv) cross modulation; and (v) automatic gain control.

9(a) Find the total capacity when three capacitors of 3, 6 and 9 microfarads respectively are connected: (i) in parallel; and (ii) in series.

(b) Calculate the capacitive-reactance of the series combination in (a) when connected across a 50 Hertz supply.

SECTION K (Regulations)
Time allowed — 30 minutes)
NOTE: THREE questions only to be attempted. Credit will not be given for more than THREE answers. All questions carry equal marks.

1 What action should be taken by an amateur station licensee when informed that transmissions from his station are causing interference to the reception of television or broadcast programmes?

2 State the regulatory requirements concerning the recording and re-transmission of another amateur station's transmissions.

3(a) State the maximum power which may be used in an amateur radio station using: (i) amplitude-modulated double-sideband emission (A3); (ii) single-sideband suppressed-carrier emission (A3J).

(b) Briefly describe the method for determining the peak envelope power of a single-sideband suppressed-carrier transmitter.

4 Give the "Q" code abbreviations for the following: (i) Shall I send faster? (ii) The name of my station is . . . (iii) Your signals are fading. (iv) I have nothing for you. (v) When will you call me again?

Reprinted from *Amateur Radio*, Journal of the Wireless Institute of Australia.

novice

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Who's In Charge Here?

Questions about the "control operator" can show up on either the Novice or the General license exam.

The control operator is the licensed amateur who is actually operating a ham station whether the station belongs to him or someone else.

Let's say you have your Novice ticket and your call is WN9LHO. When you're operating your station you are known as the control operator and the licensee of WN9LHO (since it's your license). You are in charge of the station and you are responsible for its proper operation.

A friend of yours, WN9LJW, comes over and wants to operate your station for a while. You say sure and retire to the corner pub for a few tall ones while your friend uses your station. You are still the licensee of your station, but you are no longer the control operator. WN9LJW is the control operator.

Both of you are now responsible for the proper operation of your station. You are because you are the licensee; WN9LJW is because he is the control operator.

Let's say that instead of WN9LJW that your friend happens to be WB9LJW, who has his Advanced class license.

WB9LJW can operate your station and sign your call as long as he stays in the Novice band and uses 75 Watts or less. But here's the interesting part. WB9LJW can also operate your Novice station in the General and Advanced bands (including phone) if he signs both your and his call like this, ''K4EMX de WN9LHO/WB9LJW', or on phone, "K4EMX from WN9LHO with WB9LJW as control."

It doesn't work the other way around though. You can't go to WB9LJW's station and operate in the General and Advanced bands as the control operator. A control operator may not assume operating privileges greater than those granted by his license. You have to stay in the Novice bands and use 75 Watts or less, if you are a Novice licensee and the control operator at WB9LJW.

However, you could go to WB9LJW and operate his station as a "third party." So can anyone else, whether they have a license or not. This means *that* while you are *operating* WB9LJW, he or another control operator has to be present and able to continuously *monitor and* supervise your operation to make sure you don't violate the rules. If you want to operate sideband in the General bands the control operator has to have at least a General class ticket. If you want to operate CW down in the Extra band segment then the control operator has to have an Amateur Extra license.

Let's say WN9LHO has a friend who knows the code pretty well visiting the station. The friend doesn't have an amateur license. That friend can operate CW at WN9LHO's station as long as the licensee or another control operator is present to supervise the third party operator.

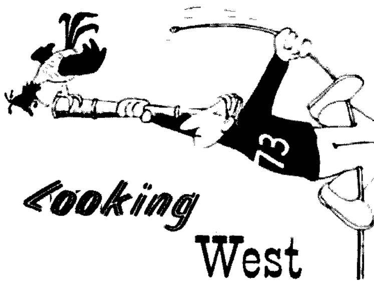
Maybe WN9LHO's XYL learns the code. She can operate his station as long as LHO or another control operator is present to see that she observes all the rules and regulations.

You may have a friend whose license has expired. It's perfectly legal for him to operate your station as long as you or another control operator is present.

Just remember that if you are a control operator at another station you are responsible along with the station licensee for the proper operation of the station.

If you knowingly and flagrantly violate the FCC rules while you are the control operator, both you and the licensee can get into big trouble fast. You can't say as an excuse, "Yeah, but it's his station!" and he can't say as an excuse, "Yeah, but he was control operator!" Both of you can be blamed and held accountable.

. . .WB9LHO



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Shows you how you can never be sure of anything these days. In part II of my coverage of the November '74 SCRA meeting I went and gave all that lovely information about how the problem of solving a frequency allocation need for amateurs in Mexico had been concluded so successfully at that meeting. Well, everyone thought it had, so I reported it that way. Turns out that I was a bit ahead of myself, as the updated information that appeared in Hotline will attest. (Another case that proves the utility of Hotline.)

True, a tentative agreement had been reached at that meeting. However, this fell through when one of the systems that had been requested to move to an alternate channel pair decided to stay put where they were. So, after many months of work, the SCRA found itself right back at the starting point with the amateurs in Baja becoming impatient for some affirmative action on their behalf.

A final settlement of this problem was brought about by the generousity of one Doug Andrews K6VGH. Doug is the owner of a West L.A. based system under the call of WR6ACK. You might remember my writing about 'ACK some months back, when they tried to put up the first open autopatch system in Los Angeles. Unfortunately, the attempt was a failure and the autopatch function was taken out of service. Since that time 'ACK has been one of those nice quiet local coverage machines that abound in Southern California. After approaching many other repeater owners in an attempt to secure a set of standard 30 kHz split channels to assign to Baja, the SCRA approached Doug and explained the problem. In turn, Doug generously agreed to move WR6ACK to 146.805 – .205, doing so *in the interest of true international amateur radio cooperation.*

Let's face it: No one can blame the owners of the other systems asked to move for declining to do so. Changing channel allocation for a repeater can be an expensive proposition, especially for the system users. For an average system of 50 users, that's 100 crystals at $7 each plus two for the repeater itself. Aside from the economics, you still have no idea of what other electronic problems you will face on the new channel: Intermod, mixes, etc. That is why our hat is off to Doug. He is taking 'ACK to a split-split channel from 147.93 – .33 so that the new Baja California repeater can come to pass. I'll tell you, if there was a "Good-Guy" award in amateur radio, I would personally nominate Doug Andrews K6VGH for it!

And I ended the article in the January newspages "P.A.R.C. does and SAROC is next. Hmmmmmm WR7FM?". I was talking about the portable repeater that the Palisades Amateur Radio Club had taken to San Diego under the callsign WR6FM. Well, to be honest, I did know something at that time, but since the license for WR7FM had not arrived at Fred Deeg K6AEH's house yet, we could not be sure. So, we only hinted. The license did arrive in plenty of time, so that within hours of the time the convention started, the voice of Bella WA2CZU could be heard on 146.61 announcing: "Hi; welcome to SAROC. This is WR7FM Las Vegas. A special events repeater station sponsored by the Palisades Amateur Radio Club of Culver City, California." Having the P.A.R.C. portable repeater was a real benefit to those of us with .01 – .61 in our radios since it was all but impossible to get a word in on either WR7AEH (.34 – .94) or on .94 simplex. I have heard unofficially that this year the turnout was better than ever probably due to the excellent weather and the decision to move the show back to the Hotel Sahara.

There has been a lot said and written, pro and con, about this particular event and I have heard both sides of the story many times over. For me however, this was my first SAROC and I decided to go there and report on it as objectively as possible. For better or worse, here goes.

First, if you go to SAROC looking to find an amateur convention like San Diego or Dayton you will be very disappointed. By far it is the most disorganized event of its type I have ever attended, though I will admit I have not attended many such functions. This, though, is not to the discredit of the convention, but rather it is due to the "Fun-Fun" atmosphere that *is* Las Vegas. I think that it is the aforementioned atmosphere that accounts for the lack in number of formal symposia that abound at many other conventions. At SAROC this year there were but two major sessions: A 2½ day on-going FM Forum led by Dick Flanagan W6OLD, Chairman of the SCRA, and the ARRL Forum led primarily by ARRL President Harry Dannals W2TUK. In both cases, the discussions mainly revolved around Docket 20282 and its effect on the amateur populace. Having "wagon-trained" up to Vegas with Dick Flanagan on .52, I had a fair understanding of what was to be covered at the FM Forum and therefore I did not attend same. I did get in on the tail end of the ARRL forum and basically I received the impression that whatever you as an individual felt in relation to 20282, it was your responsibility to read it and comment back to the FCC as they have requested.

As for the displays, from my observations the two that drew the most attention were Icom and Yaesu. Icom had their new DV-21 Phase Locked Digital Programmable VFO hooked to an IC-21A, and you just couldn't keep your fingers off this little gem. The DV-21 lets you operate any channel and any split you want, scan the entire band from 146 to 148 and tells you where you are to the last 5 kHz. You simply have to see it operate to believe what it will do and how easily it will do it. Yaesu's 200R Sigmasizer and FR-101 Digital receiver also drew a respectable on-going crowd.

Back to the convention as a whole, it is obvious that the aura of Las Vegas is what brings people to SAROC each year. If, like me, you enjoy the night life that this city has to offer and do not mind fattening the coffers of the various casinos, then you will enjoy going to a "SAROC". (OK, we only lost $15 on the slots, so there is nothing to complain about. The shows are my cup of tea, and the ones Sharon and I attended were the most lavish put on anywhere.) In my view, SAROC is a good excuse to go to Las Vegas and enjoy myself and have the pleasure of again seeing such friends as Art Householder of Spectronics, Dave Flynn W2CFP (who, among other interests, puts out a fine Newsletter each month as the Hilltopper) and Mitch Wolfson WA6GSN, who not only treated us to a fine dinner but acted as our guide at

Continued on page 16

LOOKING WEST from page 14

the beginning of the convention as well. In closing, if I had to describe what SAROC is in one sentence, I would have to say that it is a fun gathering held for those who happen to share an interest in amateur radio, but not an amateur radio convention devoted solely to amateur radio as an entity unto itself. If you are like us and enjoy a fun time that does not necessarily revolve around amateur radio 24 hours a day, then a gathering such as SAROC is for you. On the other hand, if you are of the school that believes an amateur radio convention should be that and nothing more (an extension of the QSO, the coffee house technical seminar, the fully structured radio club meeting that follows traditional rules of order) – well, SAROC is none of this and you are going to have a lousy time. Sharon and I had a good time in Las Vegas as always, but it was the fact that SAROC was being held now that induced us to visit there again at this time. I suspect that it will influence us again the same way next year.

Finally, as those of you again who read Hotline already know, the Technical Committee of the Southern California Repeater Association has decided to adopt the Mt. Wilson Repeater Assn. Tertiary Split band plan, rather than the ARRL band plan. The MWRA plan inverts the split-split channels so that the repeater user's receiver always sees a clear 30 kHz slot, since the channel either side is a repeater input. What this means is that unless your next door neighbor is operating on an adjacent channel 15 kHz away, there should be little or no interference either to or from adjacent systems. It is nice to see a coordinating group made up of repeater owners that is responsive to the needs of users. The SCRA is such a group, one willing to put technological development of the VHF spectrum ahead of tradition. If you are interested in learning more about the SCRA, or if your coordinating group wishes to exchange ideas with them, they can be contacted at P.O. Box 2606, Culver City, CA 90230. They have accomplished a lot because they are willing to lead and willing to listen.

. . .WA6ITF

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

Around and About

Larry WB5CWB proudly announces confirmation of Nebraska in the person of John WØEKB to complete the continental 48. The contact took place on Friday the 13th last December. "I attribute the Nebraska contact to my new 8 element KLM 6 Meter beam. Sure is great. Also, John hanging in there with me. Thanks to John and KLM."

Perry WA5IKU says "Not much to report other than an Es opening 12-26, worked several Ø-4-8-9 between 1545 and 1705 CST . . . I might mention that I worked several of the new North Carolina 6 Meter Association members, I understand if you work five stations (and send) $1 to Ken WB4MXC you can receive a nice piece of wallpaper. I worked 4, looking for the 5th."

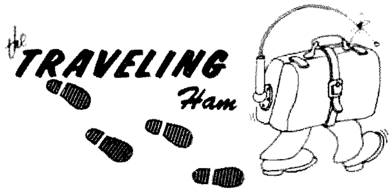
Received a long and detailed letter from Ted WA9FEE outlining activity to and from northern Illinois during November and December . . . Ted seems to have had better than average conditions from the number of contacts made and the areas covered. Unfortunately space limitations won't allow a blow by blow description. There was one note of sadness included, that being the information that Leo WA4MHS had passed away the first week of December. "Leo was very active on 6 Meters from New Port Richey, Florida and made many good friends on 6 – he is going to be missed. Leo was a member of SPESM. At the time I am writing this the club is setting up a memorial fund in Leo's name, probably through ARRL . . . to be used for either a task force or committee on 6, or to further the advancement of 6 Meters . . . the fund will be carried on whenever another avid 6 Meter operator passes away – I will let you know when I can get the information on the address and fund name." On other subjects Ted says, "Four groups in the 6 Meter Council, SMIRK, 6-6, SPESM and the newest, NCSMA, the North Carolina Six Meter Association. I for one can't understand why other groups have not joined, the only cost is stamps, exchanging newsletters, views and coordinating our efforts to create a better band on 6. If anyone is interested in joining SPESM, the only requirement is $2.00, which entitles them to a nice certificate and a monthly newsletter . . . contact us through P.O. Box 768, South Elgin, Illinois."

Band conditions in the Midwest have been very poor this last Fall. November brought a few unexpected openings but the usual December activity was almost entirely lacking. This is not to say that there were no openings. There were some, but these were not of the intensity or duration or, for that matter, the frequency that we have come to expect at that time of year. With very few exceptions the letters received and contacts made indicate this to be a general trend all over the country, not just a local problem. WA1EXN and WA1OJB (Art and Bob) in an extended but sometimes marginal contact a few evenings ago made about the same comments about conditions from their Maine location. There was mention of a good opening December 14th but through most of the month and into early January conditions were nothing to brag about.

I ran across Joe WB4OSN on 15 Meters one afternoon last week and naturally the conversation revolved around our favorite band. Joe said essentially the same things repeated above . . . the big deal for the month was hearing the TI2NA beacon one time. Joe has been talking up 6 Meters on 10 Meters of late and has gotten some interest started in several South American countries. In particular, HC8GI is beginning to express the desire. The push is on to use 29.530 as a 10 Meter meeting place.

One last bit of news . . . Joe says Bob '4PKW has applied for a VP7 call (prefix soon to be changed) in hopes of lining up a trip to the Bahamas sometime in the Spring . . . hopefully during June contest week. This will be something new for the many who have gotten on the band since the days of Scotty VP7DD.

. . .WAØABI



Joe Kasser G3ZCZ
1701 East West Highway, Apt. 205
Silver Spring MD 20910

Delays in processing license applications are not unique to the USA. A notice published in the Journal of the Wireless Institute of Australia, August 1974 reads . . .

"Licensing Delay in VK3.

If you have passed the examinations and have made application in Victoria for a license (or if you want a change in call sign or wish to reserve a call sign) you must expect to face a normal delay of about three weeks before getting your license." Three weeks — that's just due to the post office in this country.

The New Zealand Association of Radio Transmitters Inc. 1974 Callbook contains an item that advises overseas radio amateurs that holders of certificates issued by Australia, Canada, the United Kingdom, Eire and the Cook and Nive Islands can be granted reciprocal licenses on payment of the ubiquitous fee. The class of license is as follows:

Grade 3. VHF only for those with less than 12 wpm Morse.
Grade 2. 160, 80, 6 and up, for those with 12 wpm Morse but no evidence of operating experience.
Grade 1. Full privileges on all bands, for those with 12 wpm Morse and proven experience.

Now to Europe. The focus this month is Spain. The Spanish radio club is called La Union de Radioafeicionados Españoles, and they publish a monthly magazine called U.R.E.

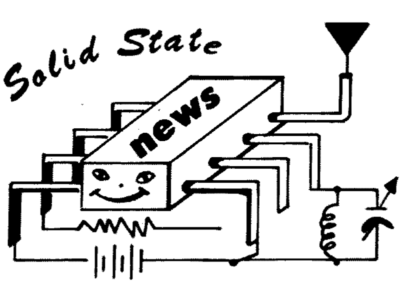
The magazine contains a number of advertisements for locally made VHF equipment as well as the ubiquitous Kenwood and Sommerkamp ones. If you plan to visit Spain you might find this list handy. It is a list of local representatives of the URE, so with this list and a call book you might make a useful contact.

Madrid	EA4JF
Baleares	EA6BC
Granada	EA7IE
Sevilla	EA7NJ
Valencia	EA5GO
Barcelona	EA3BD
Cadiz	EA7AR
Las Palmas	EA8CI
Tenerife	EA8AH

Since the Spanish hams are very active both on HF and on VHF, it would be nice if you took as gifts the usual hard to find (over there) components such as rf power transistors for the home brewers, mint (commemorative) U.S. postage stamps for the DXers to get QSLs direct from stateside QSL managers, and integrated circuits of any kind. If you are not going for some time, it would be a good idea to write ahead and let them know that you will be visiting, that you would like to meet some of the locals. Give some details of your proposed itinerary and ask if there is anything you could bring along that they might find useful. Suggest one or two things so that they have some idea of the type of things you mean. The language in Spain is slightly different from the language of South and central America, even though they are both called Spanish. There are pronunciation differences and the use of idioms is different. It is somewhat like the difference between English as it is spoken in England and English as it is spoken in the USA. In fact after four years of marriage to my American wife I still find that we are talking different languages.

To finish off, on a recent trip out of town I forgot my charging cord for the TR-22. On hearing of my plight someone, and I can't remember who, suggested that a TV cheater cord would make a good substitute. Do you know that he was right? It works fine — just remember to take the rig to the store with you to ensure a perfect fit.

. . .G3ZCZ



Waller Scott K8DIZ
7318 Hollywood Drive
West Chester OH 45069

A new digital voltmeter IC has appeared on the scene. It is the Analogic Corporation MN2301 one-chip DVM. Unlike other voltmeter ICs, the 2301 contains both digital and analog portions of the circuit on the same chip thus reducing interconnections and the need for as many outboard components.

This IC has been under development for three years and it was not an easy task to obtain the integration of both digital and analog circuits on the same chip while striving for the required accuracy, power requirements, and other features. The chip design was first implemented for Analogic by a European company and then transferred to the U.S. for production by another semiconductor manufacturer.

The 2301 is a 3½ digit DVM of the dual slope integrating type. With the addition of dc reference voltages, power, a clock oscillator, a display strobing IC and a few resistors and capacitors it becomes a fully operational DVM capable of driving a LED display.

Specifications for the IC are an accuracy of 0.1%, temperature coefficient of 100 ppm/°C, an input impedance of 1000 megohms, and input current of 0.1 nanoamps.

The circuitry included on the 125 mil square chip includes an input amplifier, integrator, comparator, control logic, digital display outputs, zero level hysteresis control, polarity indication, under and over range indication, and an automatic zeroing circuit. The device is fabricated using P-channel MOS techniques. The 2301 can also take a triggered reading.

Analogic claims that by lowering the number of parts required to make a DVM, lower overall prices will result in more widespread use of DVM's and create new applications. They plan to use the MN2301 in a digital panel meter called the 2538, which will contain 20 to 30 additional parts and a ½ in. LED display. This panel meter measures dc volts only, but could be the basic part of a complete DMM with added range and function control circuitry. The 2538 DPM requires only 1.5 W of power and costs $89.00. The MN2301 IC is $39.00 in single quantities (Analogic Corporation, Audubon Road, Wakefield, Massachusetts).

Dual gate FETs have been around for a spell but new devices appear occasionally that should be of particular interest to hams. Two of these are

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the 3N209 and 3N210. These dual gate transistors are designed and characterized for UHF communications applications. Both are rated at a common source power gain of 10 dB min. (13 dB typical) at 500 MHz. Features include zener diode protected gates, silicon nitride passivation for excellent long term stability, and excellent intermod distortion performance. Maximum drain-source voltage is 25 V and optimum drain currents are 5-10 mA. A typical noise figure of 4.5 dB can be obtained at 500 MHz with even better performance in the next two lower ham bands.

The 3N209 comes in a hermetically sealed TO-72 metal can and the 3N210 in a "MICRO-H" plastic package that looks like a very miniature IC with 4 leads (2 on each side). The 3N210 will solder nicely directly to stripline circuits. Reverse feedback capacitance is an extremely low 0.023 pF!

These devices are currently available from Motorola but will likely be sold by others in the near future. Prices: 3N209 @ $1.35, 3N210 – $1.10.

432 MHz has attracted DXers for many years, but recent interest in the rest of the 420-450 MHz for FM and repeater operations promises to increase the population of this, our widest "low frequency" band – low frequency compared to microwave, that is! The field of VHF and UHF power transistors has seen some tremendous accomplishments in the last few years. The latest additions to the UHF field of high power transistors are the Motorola MRF621 and RCA 40971 45 Watt devices. These transistors are designed specifically for 12.5 V dc operation.

The MRF621 is the latest in the state-of-the-art series 450 MHz "CONTROLLED Q" power devices from Motorola. This device is spec'd at a minimum power gain of 4.8 dB at 12.5 V dc and a frequency of 470 MHz. The minimum collector efficiency is 55%. When operated in the 420-450 MHz band typical gains of 6.5 dB can be obtained. All units are tested to withstand a load mismatch at all phase angles of 20:1 VSWR and at rated input power. An internal MOS capacitor chip is utilized to form a "T" type matching network inside the transistor. This technique of internal matching networks Motorola calls "CONTROLLED Q."

At high frequencies, the transfer of rf from a signal source into the base of a transistor has presented one of the most difficult problems in the efficient design of solid state power amplifiers. Ideas have been borrowed from IC fabrication technology to help solve the problem. The insertion of a matching network into an rf power transistor package gives the transistor a consistent and highly controlled Q. This controlled Q means that these devices are easier to match into the surrounding circuit networks and offer better consistency of other high frequency parameters than the standard rf power devices. At 450 MHz this can mean an increase from the previously available gain of 4 dB to 6 dB. For an input of 10 Watts, this can make the difference between only 25 Watts of output and 40 Watts.

With the new controlled Q devices, location of some of the impedance matching elements inside the package brings the network closer to the active transistor die. Not only does this eliminate some of the required external components, but it also means that a small amount of capacitance can minimize the imaginary part of the input impedance for maximum bandwidth. This keeps the input impedance virtually constant over the 420-450 MHz band in the MRF621. In addition, the internal construction techniques help establish a better signal ground by removing most parasitic reactance. Fig. 1 shows a schematic of the elements actually contained within the transistor case.

Controlled Q transistors use both monolithic and hybrid assembly techniques in their construction. The transistor die is fabricated using monolithic IC methods. A small MOS chip capacitor is wire bonded to the transistor die using hybrid technology. You can think of the resulting assembly as an active transmission line element for UHF amplifier design. The photo shows a closeup of the die and capacitor used in the MRF621.

Because of the high power handling requirements of this type of transistor, it is specially constructed with each of its many emitter sites having its own series ballast resistor. These resistors are made of nichrome and have different resistances in order to

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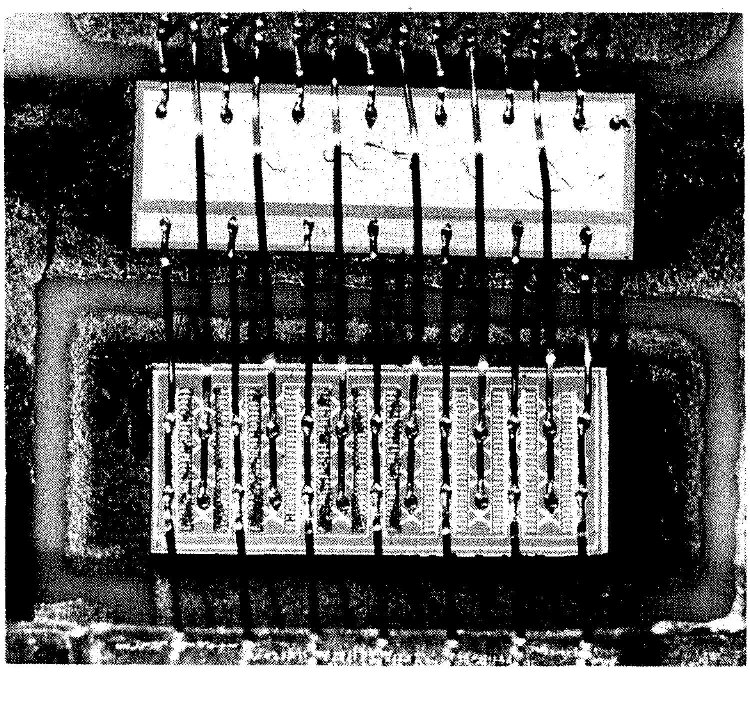

Inside a CQ Transistor.

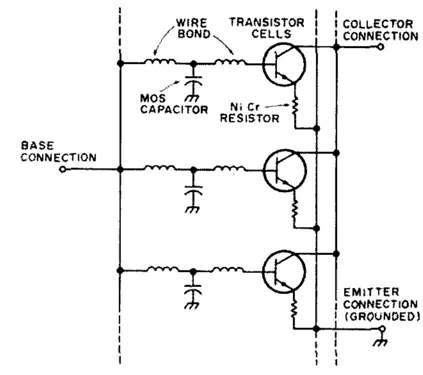

Fig. 1.

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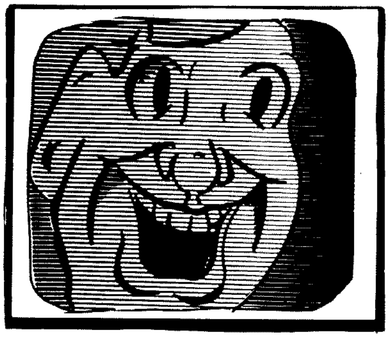
compensate for the thermal differences at various portions of the transistor chip. This prevents overloading of some of the emitters due to temperature differences. This technique of emitter ballasting assures balanced current distribution throughout the transistor for more consistent operation at various power levels. Many rf power transistors available today make use of this type of emitter ballasting construction. Careful examination of the photo will show the many emitter contact "fingers" (metalization). The nichrome resistors are attached to each of these "fingers." CQ transistors have bonding wires extending from the base regions to the capacitor chip and then on to the package base lead. These bonding wires and the MOS capacitor form the matching network shown in Fig. 1. So much for the intricacies of rf power transistors. The MRF621 is available from Motorola for $39.00 in quantities of from 1-24. At less than a dollar per Watt, the MRF621 is a pretty good deal!

The RCA 40971 is almost identical in all specifications to the MRF621 and is mounted in the same type package, which is designed specially for efficient heat sinking of power devices. The package consists of a flange base requiring 2 bolts for mounting to a heat sink. The flange is electrically isolated. Four wide leads protrude from the encapsulated transistor die mounting area, 2 emitter leads, collector, and base. The 40971 is not quite as good a deal at $60.00 (1-99).

Why not start building your UHF mobile rig right now? 73!

...K8DIZ

SSTV SCENE



Dave Ingram K4TWJ
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Birmingham AL 35210

Save the P-7 Monitor

During the last few months I've been talking quite a bit about Slow to Fast Scan conversion. However, I don't want to give you the impression that regular P-7 type SSTV monitors are becoming extinct. Indeed, they still have several outstanding advantages. Sure, this era of poor propagation is a fine time to build gear and the advantages of scan conversion are obvious – bright pictures that can be viewed indefinitely on your regular (Fast Scan) television. But memory chip cost, coupled with our present economic status, still place the P-7 monitor as the easiest and most economical approach to SSTV. It will be a fair time yet before commercial manufacturers can build Slow to Fast Scan converters that everyone can afford. Several of the Fellows with scan converters say that ordinary P-7 SSTV pictures appear more natural and life-like than scan converted pictures. Possibly this is due to the extremely high definition capabilities and the minute instability in most scan converters. I think the situation could best be summed in saying that old time SSTVers would enjoy the scan converter while newcomers would prefer a regular P-7 monitor.

Spooky Subject

Several of the fellows have asked how multipath propagation creates "ghosts" on received pictures, so here's a brief explanation. Let's say there is a station in Germany transmitting to the United States. While the signal travels directly across the Atlantic Ocean, another wave of this signal also travels long path and across the Pacific to the United States. The long path signal travels much further than the direct signal. Thus, when received, there is an initial signal followed in one or two milliseconds by the long path "echo." Now, a SSTV Monitor sweeps each scanning line in 66 milliseconds, so the one or two milliseconds delayed picture produces a shadow or ghost to the right of the initial image. The brightness of this ghost depends on strength of the long path signal. Savvy?

DXCC on SSTV

Our long time DX leader, Gene W8YEK, finally hit the 100 country mark during November.* A Slow Scan first! As Gene is retired, his trump card was the availability of time necessary for such an endeavor. No doubt W4MS, W6KZL and some others are close on his heels. The world of SSTV is looking brighter!

New Robot Gear

Robot Research is on the move again. This time the result is a model 70 B Monitor and 80 B Camera. Their new monitor boasts a built-in viewfinder function plus a built-in demodulated SSTV waveform display. The 80 B Camera now features ALC (Automatic Light Control) and two axis sweep reversal controls. Owners of "A" model gear may obtain modification kits for these features directly from Robot.

*Our apologies to Gene W8YEK (and bread and water to our proofreaders) for misprinting his call on our February cover. An update from Gene: "I worked KZ5LG, 2XSSTV, and EI7D – total countries worked is 102. I have 96 confirmed as I received a card from EP2FB, HC1BV and EI7D." – Ed.

Newsy Notes

G3AID appears to be leading the European DX Pact with 73 Countries worked on SSTV. Richard G3WW is right behind him with 63 SSTV Countries. Richard is also the first British station to work SSTV mobile. G3OXY and G3WW report seeing I5SBF's good quality SSTV pictures through Oscar. Any stateside viewers of European SSTV via satellite? The United Kingdom SSTV Net is reported meeting on 3735 kHz Sundays around 1000 GMT. Any of you "early birds" catching this one? G3WW relates that the English Secretary of State for Home Affairs (formerly the Ministry of Postal and Telecommunications) reports issuing at least 125 "permits to transmit SSTV."

The most well known U.S. SSTVers in Europe are W4MS, WØLMD and W6MXV. Their circuits are popular overseas although transistors replace some of the IC functions. This situation makes sense when you consider their integrated circuits are expensive but transistors are extremely plentiful.

Australian SSTV activity is being promoted by the Eastern and Mountain District Radio Club, P.O. Box 87, Mitcham, Victoria. Their members are producing PC Boards for a SSTV monitor (Model X51) and camera (X52) which can be built for a very reasonable outlay of funds. One of the club's outstanding achievements is the development of an E-26 phosphor. This E-26 phosphor can be sprayed into a regular TV picture tube during the rebuilding process. The result is a

reddish-orange picture minus the bright initial trace which is common with P-7 tubes. Typical high voltage utilized is 15kV and it is reported the pictures can be viewed in relatively bright lighting conditions. The SSTV Club now has a TV picture tube rebuilder manufacturing re-phosphored and re-gunned SSTV tubes. Approximate off-the-shelf cost of an eleven inch SSTV tube is twenty-seven dollars.

Gervie W7FEN has been quite busy lately with several SSTV projects. His latest development is an external Independent Sideband adapter for the Drake TR-4C Transceiver. The outstanding feature of this unit lies in the fact it can be unplugged from a jack mounted on the TR-4 when normal operation, like mobile or portable, is desired. This converter could be a tremendous boost for ISB. I will have more information on this as it's available. There's also talk "in the wind" that Swan Electronics is working on an ISB Adapter for one of their transceivers. Gosh – the West Coast is hot on Independent Sideband!

There is a fair amount of Slow Scan activity beginning to appear on 3845 kHz each Wednesday night around 8:00 pm Central Standard Time. A wide array of SSTV subjects are discussed and the format is relatively informal. Possibly this switch to 75 Meters is due to the poor propagation on 20 Meters.

Overseas Broadcasts are crunching our 40 Meter SSTV frequencies of 7171 and 7220 kHz. If any of you are operating on 40 Meters, how about dropping me a card describing your success.

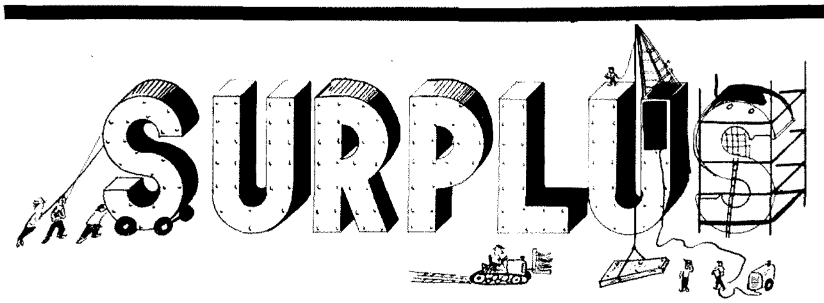
W8OZA is now producing PC boards of the W9LUO MK II SSTV Monitor I mentioned a few months ago. This straightforward, inexpensive monitor is an ideal way for the neophyte to get started in SSTV.

Words or Pictures

I am still concerned about the large amount of printed material being exchanged over the air. One can verbally tell a contact anything that can be written on a monitor screen, but pictures actually show that rig or special project. Slow Scan differs from RTTY in that it is a *visual* means and it doesn't make sense to use this means exclusively for facsimile type communication. Many (if not all!) SSTVers have some very interesting items around their shack, but instead of televising these, they transmit sketches or ID's. A certain amount of printed material is fine (and I'm not bucking that) but don't neglect using SSTV as a communications window also. Several fellows have enjoyed seeing my antique transmitters and receivers, my home brew linear in a TR-4 cabinet, the way my station is arranged and my "trick" 2 foot integrated circuit. The point I am making is this – Use the SSTV Camera as a *communications aid* and strive for more meaningful QSOs. Try to give your contact the impression of an actual visit. The results will be immensely gratifying.

In future columns, I will go into detail on camera operations – picture make-up, lighting and taping. Meanwhile, why not try your hand at transmitting some live pictures off the camera. Until then, 73.

. . .K4TWJ



Bill Turner WA0ABI
Associate 73

The first item on the agenda this month is crystals. Quaker Electronics, P.O. Box 215, Hunlock Creek, PA 18621 is the supplier of all the following at the most reasonable price of $1.10 each postpaid. For the 6 Meter AM buff there are HC-6/U types at 50.3, .4, .5, .7 and .9. For the clock builder there are 360 kHz and 3.6 MHz for simple time-bases using only a 7400 gate for the oscillator and four or five 7490's for dividers. For the HF nut there is a 2.5 MHz crystal which would make an excellent calibrator with outputs at 500, 250, 50, 25, 5 and 2.5 kHz and requiring only the 7400 and three 7490s. For the 2 Meter FM fan a 3 MHz crystal is available which will when divided by 100, produce markers every 30 kHz, which pinpoints every repeater and simplex channel. In this case it would be best to use a 74H or 74S gate as an output buffer in order to increase the harmonic output. Last but not least, there is a 5.000000 HC-6/U manufactured by McCoy which would be excellent for a counter time-base. In the counter which comes to mind, the K2OAW published in 73 during 1972, the crystal specified was 10 MHz. Modifications required to use this crystal are minimal. It is only necessary to jumper out a divide by two section of a 7490 somewhere in the time-base divider chain.

For the FMer or the owner of one of the new low power SSB rigs, Olson Electronics lists a 6 Volt, 6 Amp/Hr wet cell (dry charged . . . supply your own acid) for $2.88. You would of course require two for most rigs. Also of interest is a UHF TV tuner marked down to $1.99 through the 24th of February. This is the same item mentioned several columns back as a possible converter for 420 MHz. For the FM receiver builder Olson has a 10.7 MHz FM i-f strip for $1.59 (#XM-355X) or a similiar unit with a multiplex detector (#XM-354X) for $1.79. With the addition of a converter and an audio IC this should make a reasonably good monitor receiver for the ham bands or public service frequencies. One final item . . . a 12 Volt charger for the previously mentioned batteries, rated at 2.3A for only $2.49. For the repeater crowd there is a TV remote control chassis including a stepper relay, power relay, switching relays, transistors, etc., etc., for $7.98. Olson is located at 260 S. Forge, Akron, Ohio 44327 and has a handling charge of 50¢ for orders under $5.

CPO Surplus, P.O. Box 189, Braintree MA 02184, has a number of smaller items of the types so often needed by the builder. Plastic and mica filled, 3 and 4 pin transistor sockets – assorted – 20/$1.00 or 100/$2.50. Disc ceramics; 2.2, 2.7, 8.0, 15, 100 and 500 pF, your choice 20/$1.00. 470 or 500 pF button mica's, your choice 10¢ each, 500 Ohm or 500k PC mount 1/4 Watt

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pots, your choice (may be mixed) 20/$1.00, 1N34 equiv Germanium diodes, leads formed for PC mounting . . . 100/$1.00. Augat Nylon (HC-6/U) crystal sockets . . . 10/$1.00, and mica/ceramic padder capacitors, PC mount, 3-60 pF also 10/$1.00. There is 50¢ handling charge for orders under $3.00.

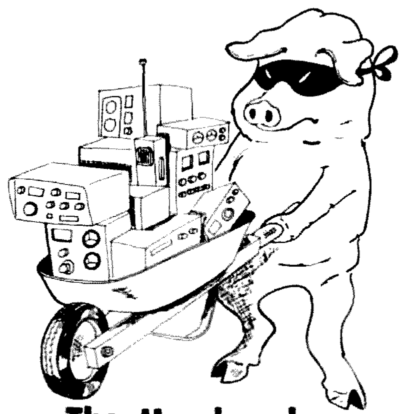
Through February 28th Burstein-Applebee, 3199 Mercier St., Kansas City MO 64111, is featuring the Midland model 13-902 weather radio at $9.95, reduced from the regular $15.95. This model is easily converted to repeater or public service monitor duty by merely padding the oscillator. For linear builders B-A has 1 Amp/4000 piv diodes at 2/$2.95. These are 3/4 x 3/4 x 3 inches (18 x 18 x 75 mm) with 2 1/2 inch mounting centers (62mm) and solder terminal connections. For the low voltage/high current applications around the shack there are 12 Amp/100 piv diodes (Motorola MR 1121) at 3/$1.00. B-A charges $1.00 handling on orders under $10.00.

Another good source of disc ceramic capacitors is Brigar Electronics . . . if you like to buy in quantity or split a batch among several people. Brigar currently lists 8.2, 11, 15, 100, 220, 390, 620 and 820 pF discs at $3.00 per hundred or $15.00 per thousand. All are 500 Volt rated and are of various tolerances and characteristics. In silver mica Brigar has Cornell Dubilier DM19 types in 270, 300 and 430 pF, 5%, 500 Volt at 7, 7 and 9¢ each. They also have the DM15 in 300 pF, 5% at 7¢. In 1/4 Watt resistors the 5% type manufactured by Spear are 3¢ each in 100,2700 and 51k values. For the ham who has everything– new, boxed, Eastern Microwave model 10-1259 high power dummy load, dc to 4 GHz, 50 Ohms, 1 KW and requiring point 218 gal/min water flow for each 100 Watts dissipated. The price is a mere $29.95. Minimum order is $5.00, the address is 10 Alice Street, Binghamton, New York 13904.

B & F Enterprises, 119 Foster St., Peabody, MA 01960, has some excellent filter capacitors for the linear builder. These are 25 OUF at 330 Volts and priced at $1.25 each or 12 for $12. Your $12 buys (in round numbers) 2 OUF at 4 KV or twice the capacitance at half the voltage. Not a bad deal at all . . . For the military surplus nut/MARS member with a mad desire to run a selsyn or similar piece of 400 Hz gear, B & F has the answer if the requirement is for 70 Watts or less. For $3.00 plus shipping they will send you an inverter transformer and schematic to make such a supply. Not much else is needed – a pair of transistors, a couple of resistors and capacitors – and you are in business running the equipment as it was intended.

Your comments are solicited as to what kinds of surplus you would like mentioned. If you need something in particular . . . drop me a note (SASE appreciated) and I will try to come up with the item you need . . .

. . .WAØABI



The Hamburglar STRIKES AGAIN!

Mfr., Model, Ser. No.	Owner	Issue
SBE Model SB-144 No. 46316 $25 reward $25 for information for arrest and conviction of thief.	K4KVF/5	7/74
Clegg 27B No. 27103-2891	WA1ECF	7/74
Clegg 27B No. 27104-3498	W9VHD	11/74
Drake TR3 No. 12746A	W9VHD	11/74
Collins 30L1 No. 29625	W9VHD	11/74
Drake TR22 No. 620272	K3NCL	11/74
VHF Eng. 1501 amp	K3NCL	11/74
Std. 826M No. 203085	WA9VNW	11/74
Motorola Motran VHF Trans Serial No. DG153W	Contact 73	11/74
SBE SB-144 2m FM Trans Serial No. 720087	WA3IID	11/74
Varitronics HT-2, 146.97MHz Serial No. 640256	K3ZPH	11/74
Unimetrics Ultracom-25 Serial No. 090561	VE7AZG	11/74
2 mtr transc SBE-144 No. 620615, 2 mtr cry. & 148.29 155.655 159.21	Broulette	3/75
Standard SR-C 826M No. 110082	K2LSX	3/75
1 FT101 160 mtrs No. 82L129340/CWF	W1FX	3/75
Yaesu FT 401B No. 316104, Yaesu FV 401, No. 679927, Collins 75A4, No. 5564	Kragh	3/75
Regency HR-212 No. 2400829	K8COT	3/75
Yaesu FT401 A serial #316104 Yaesu FV401 serial #679927 Collins 75A4 serial #5564 Johnson Valient 2916	K2UPD	3/75
Std. Handie Talkie Model 146A No. 310377 w/mini-mike	WB2HYW	3/75
Varitronics HT-2, 146.97 MHz receive crystal; TR22 s/n 640256	K3ZPH	3/75
Regency HR2B 49-01726. (Engraved C FH-6 & W2EKB)		3/75
Yaesu FT401 A No. 316104 Yaesu FV401 No. 679927 Collins 75A4 No. 5564 Johnson Valient 2916	K2UPD	3/75
TR-22 12 channels - channel 6 wired together plus GLB - homemade synthesizer	WB4JFI	3/75
5 Collins Model KWM-2A transceivers, Nos. 11359, 10731, 10095, 11218, & 16066 2 Collins Model 30LI ampli, Nos. 10620 & 11012 3 Collins Model 312B-5 Control radio, Nos. 10016, 10394 & 59502 1 Collins 516F2 power sup. No. 18607 3 power sup. Nos. 12046, 12045 12015 2 Radio Rec. Nos. 2918 & 1168 1 Multimeter No. 11065	MARS Radio Station	3/75

LETTERS

NICAD BEHAVIOR

Re: K2OAW article on Nicads: Under no circumstances should "alkaline-rechargeable" cells be discharged in excess of about 25% of capacity, since they have an irreversible chemical situation which makes them only about 25% of capacity truly rechargeable.

His statement of never "completely" discharge is much too optimistic. Any discharge in excess of 25% may be very hard to recover. This is not a widely published fact I realize, matter of fact it is kept quite quiet.

I would qualify his "don't solder to a cell", to exclude "tab" cells, which sure had best be soldered.

On the matter of "salvaging" Nicads, I have found connecting a reversed cell to a *very well* filtered dc source will quite often get a Nicad going the right way which refuses to charge on a normal charger.

A nice article, the kind I like.

. . . **Jack Bayha W8BPY/7**

MORE STARK COMMENTS

I was gratified to read, in your December issue, Peter Stark's information-packed and excellently-written article on Nicad care, undoubtedly the most complete presentation I've seen in an amateur journal on this most timely topic.

I would, however, like to take issue with one thing author Stark says regarding the use of filament transformers for chargers. I believe we're missing a chance to save a few bucks if we overlook all the 12.6 V ac filament transformers now lying unused in junk boxes.

Although Stark is correct in noting that the average voltage of a half-wave-rectified 12.6 V (rms) sine wave is only 6 volts, his argument against using a 12.6 V transformer in his 5 V Nicad charger does not apply if we replace his half-wave rectifier with a full-wave bridge. Under this new arrangement, the average voltage of our full-wave-rectified 12.6 V (rms) sine wave is twice the half-wave value, or 12 volts. Since this is more than twice the Nicad voltage, we can conclude that the 12.6 V transformer is okay, after all.

The apparent contradiction stems from the fact that the battery charger *peak* voltage, not the average voltage, must be at least twice the Nicad voltage in order to obtain the desired constant-current Nicad charger characteristic. Naturally, with a peak voltage of 12.6 times root two, or 17.8 V, our 12.6 V (rms) transformer easily satisfies this requirement. To obtain an average charging current of 120 mA through the 5 V battery, use the 12.6 V transformer and a total series resistance of about 28 Ohms with the half-wave rectifier, or about 56 Ohms with the full-wave. Incidentally, another good transformer bet is the safe, el cheapo, doorbell transformer. Used in huge quantities, it rarely costs more than a couple bucks or so, and it comes with built-in series resistance.

Finally, a question for author Stark: I've heard that Nicads can be reconditioned automatically during charging by using a current made up of dc superimposed on ac. Is this true, and if so, what are the recommended charging characteristics?

Again, thanks for the great article, and I hope to hear from you.

. . . **Ping S. Chun**
WA2SGF (KH6ALN/2)

AUTHOR K2OAW REPLIES

Although WA2SGF is theoretically quite correct, practically he is cutting things too close for comfort.

What is clearly needed is a constant-current *charger. In the interests of simplicity, most charging circuits approximate this constant-current condition by using a relatively large power supply voltage and then dropping a large portion of it in a relatively large series resistor. But if all of these circuits only* approximate *the ideal condition, how good an approximation do we need? This point is open to discussion, but it is my feeling that reader Chun's 12.6 volt transformer is marginal for charging a 5 volt battery. For example, if the battery voltage drops by 2%, from 5 volts to 4.9 volts, the charging current will go up by about 1.2%. If line voltage goes up 10%, charging current will go up by 16%. This is not exactly a good approximation to a constant current, and I believe that a larger transformer voltage would be safer. The 24 volt transformer referred to in the article would definitely be a more conservative value.*

The suggestion of using a doorbell transformer is a good one, though I would be careful when using it anywhere near its rated current. These transformers are designed for an occasional burst of current, not for continuous loads. I suspect that they would badly overheat if you kept your finger on your bell button for an hour or two.

Finally, charging Nicads with a combination of dc and ac current is a technique I have heard of, but never actually tried, so I cannot report on its usefulness. The idea is that the battery be charged in spurts, separated by short, heavy discharge currents. Honeywell used this idea in one of their electronic flashes a number of years ago but, to the best of my knowledge, gave it up shortly thereafter. It was written up in a Popular Science article about three or four years ago in connection with a storage battery charger. Another reader (Lloyd W. Root, K7AS) brought to my attention an article in the March 1970 issue of 73 Magazine which described a similar idea, but mentions that he has not noticed much difference between this technique and straight dc charging. I would appreciate hearing from anyone who has had experience with the Honeywell flash circuit.

ALIVE AND WELL

Will you please let the ham fraternity know that the real K9OMA is alive and well, and does not travel about the USA repairing CB sets at truck stops from south Ohio to Kansas. As a matter of fact, I haven't left the State of Indiana in the past six months.

It seems that there is an individual using my call very freely about the country. I have notified the Chicago field office, the Kansas City field

Continued on page 24

LETTERS from page 23

office, and the Washington, DC office. They don't care. A fellow ham in Salina, Kansas has sent me a tape of my bootleg friend using my call, name, QTH and even my peculiar phonetics. The bootlegger has even had the gall to use my call in Indianapolis about 100 miles from my QTH.

... James Pliett K9OMA

TRY THAT, FCC!

I'd like to add a comment or two to your little article in Voxpoop on p. 138 in Nov. 1974 concerning reciprocal licenses in the UK. I had not written ahead to anyone here when I arrived. I contacted the RSGB and was introduced to a Mr. Bostock, a G3???, who furnished me with a sheet showing me what was needed. This was a Monday. Later that day I went to the home office at Waterloo house with my WA2TLQ license, a photo stat of same, and my passport. A lady there helped me fill out a 3 page application. Note: Important on the application is a frequency standard of some kind – you must have one – a xtal calibration is ok. The application completed, she disappeared upstairs, then returned *20 minutes* later to tell me the application was approved! Try that, FCC! *Two days* later I received G5BIU in the mail. I was impressed. The license was 3 pounds – about seven bucks – for six months. It's renewable so there you go. I am also permitted to operate as GM5, GA5 GC5 or GD5 and as portable with a /p appended to my call or from approved alternate premises with /A added. Bands are 160M, 3500-3800, 7000-7100, 14000-14350, 21000-21450, 28-29.7, 4 meters, 144-146, and some up. Been having a great time with an HW-7 and a GP.

... David Earl-Clark WA2TLQ/G5BIU

BILLINGS, HERE I COME

After reading your magazine for quite some time, I finally thought I should write to give my two cents.

I read with ever increasing fear the address from Commissioner Lee. Then your article about Japan and the state of American "Hamdom." After coming home from a six year hitch in the Navy, I was greeted with a sad state of affairs. I live in an area with a population total of about 15,000. Out of that I know of only a dozen hams. There are no regular meetings and two meters is a disaster. I had purchased an ICOM IC-230 for use in the San Diego area where I was stationed. I got plenty of use out of it down there but am about ready to trade it off up here.

One local amateur (ex-California) had a 450 remote base and headed up the local repeater (16-76) both sited on a five thousand foot mountain with a one hundred and fifty mile radius of range. During the testing period of the repeater we found the local hams would rather use simplex because they could not understand repeater usage. So now that our license is on the way, the machine sits in the local two-way shop due to lack of interest.

One day while talking to one of the few active locals (another ex-California) in the area, while parked in a store parking lot, I had someone knock on my window. When I rolled it down I was greeted with "What channel are you on, I work 19." After talking for a while, I found out the gentleman was a ham who "let his license just expire" due to knowing there was no one to talk to on two. He had sold all his ham gear and bought a CB outfit, co-phased whips and a "black box" for getting over the bootleggers. I tried to tell him that we needed more people on two and to get his license back and get active. But he said "Why should I, all the guys I used to talk to have gone CB also."

Due to the fact that I have an Antenna Specialists 3 dB gain antenna on my car, everyone thinks I've got a CB set. Out of self defense I am going to pay the extra money this year for call letter plates! I can see that if the hams don't use it, we'll lose it!

I am a Tech class and really do not ever wish to change. I feel code is out-dated and useless. While in the Navy I was an electronics technician. Due to close work with the radio men I found out that code is used as a last resort only, and of the thirty that I know, only two could send and receive over five words per minute.

Once, while in San Francisco, I went to the local Navy ham club. Although nice, I was told that I could not even use the two meter base because I was a Tech not a General. Since we take the same theory test the only difference is the code. Needless to say I never went back. What kind of esprit de corps is that? The few people who have become interested in the ham radio that I know lose interest quickly when told they have to learn code. The usual reply is "What for, I want to *talk* to people."

I soon will be working for Montana Power Co., and will be located in Billings, Montana. It's the biggest city in the state so there should be many active hams. Hopefully my enthusiasm for ham radio will not be drowned in a sea of apathy. Keep up the good work with your magazine.

... Ric Helvey WA7QZT
Columbia Falls, Montana

HAM'S HUMP HELPED

Just a few words about your Ham Help column. I sent my name for the column back in early 1974. You ran my name in the column at that time. I received two calls from local hams, WB9DVY and WN9JMJ, so we got together to study theory and code. At this time all three of us have our Advanced tickets. Thought you would like to know. Thanks again. 73.

P.S. I can truly say your Ham Help column helped me over the hump.

... Don Cook WB9LOV
Centerville IN 47330

THOUGHTFUL CB COMMENTS

I have just completed reading the December issue of 73 Magazine. I have been licensed in the class D, citizens radio service for slightly more than a year. My station affords communications between three mobile units and the base.

Since coming into the ranks of the CB population, I have probably saved several thousand miles worth of wear and tear on the mobiles, as they now do not have to come back to the base for new assignments. Of course, at various times the 27 MHz band displays propagation characteristics which are detrimental to good two-way radio communications. However, this problem stems from the continued use of rf amplifiers far above the allowable four watt CB output. I do not know the answer to stopping this, I believe the FCC is doing what it can. A recent article in a monthly magazine devoted to CB related items, showed the licensed CB population to be approaching the one million mark; of the unlicensed population who knows how many exist. Fines and

court orders evidently do not have their desired effect. Perhaps on the spot dismantling of the offending equipment would more likely get the point across. Much like the "revenuers" would dismantle a still producing corn liquor, with an axe.

The area in which I live is located only a scant ten miles or less from a main FCC office, in Norfolk, Va. There are constantly rumors floating that the FCC is in town and listening, but the chit chat, though subdued, still goes on. Most of the handle talkers hang somewhere around 27.195 MHz. For the most part they keep their chatting to a minimum, though some can be a little long winded. While using a handle and talking on a channel set aside for mobile/base communications is presently a violation of Part 95, so long as they keep their QSO short and their power in the QRP range, they do not interfere with anyone. It is the CBer who must fly with all the QRO he can get, who dominates not only the channel he is on but for 60 kHz either side, that brings down the wrath of the FCC on everyone's head.

I recently read an article stating that the Canadian DOC, our equivalent to the FCC, was considering throwing in the towel, that in so many words, they were unable to control the situation. Perhaps that is a solution in itself. Maybe by the time the log jams of QRM become so deafening people will start to wise up. Perhaps FM equipment would put a halt to it. From what I understand propagation of LD in FM is very rare. Of course this would tend to make many millions of dollars worth of AM equipment obsolete. But then again why not an FM converter much like the converters that can be attached to regular car AM radios?

I understand that proposed modifications to Part 95 would make it illegal to manufacture or sell an rf amplifier capable of operation in the 25 to 30 MHz area. Also that upon inspection of a CB radio station that if such an amplifier is even found on the premises it will be assumed that it is in use.

The proposed class E is being met with stiff opposition from amateurs. From what I have read, the 220 MHz band was in little use until this proposal was put forth; now activity by amateurs is gaining. The adage of either use it or lose it seems to have struck home. However, one fact remains; the amateur population is dwindling (I believe your figures in Dec. 74 issue of 73 Magazine states at the rate of 350 per month) while the CB population is gaining at near 4000 per month. The present licensed CB population being nearly 875,000. While the decision to allocate this portion of the amateur band may be political in nature, the sheer fact of weight of numbers will also make itself felt.

Let the hobbyist CBer go to this class E proposal, let him just have his head. However, if after the class E is allocated, should the hobbyist QRO CBer persist on 11 meters, burn him good, fine him, confiscate the equipment, and let him wear the gray uniform of the federal penal system for a while.

Well, in CB jargon, I've shot my nickel's worth. Let me say in closing that these are opinions, not of someone experienced in electronics, or anything like that, but just someone who would like his equipment to do the job for which it was intended. I've talked with the handle talkers and with the call letter operators, for the most part I am unable to separate them into good and bad guy categories. In closing I would like to thank you for taking the time to read this.

. . . **James Johnson**
Light Hauling Ltd.
KGK2528

THANKS (YOU'RE WELCOME)

Just a short note to say thank you for your study courses and cassette tapes. Without them, my passing of the general exam last September (received license early in November) would have been much more difficult.

. . . **Robert W. Gardner WA2OVT**

OLDIES ARE GOODIES

I just received my January issue of 73 Magazine about an hour ago, and after browsing through it lightly, I do my heavy reading after supper, two things prompted me to drop you this note.

The first one was regarding the letter from the priest who was unable to understand all the solid state items in the wind-direction indicator. Then your editorial when you mentioned Virginia had been talking to an old timer who had commented about not reading any of the articles on tube type circuits anymore.

I happen to be one of those old timers too, received my license in June of 1938, but my worst downfall was only getting a ninth grade education.

I realize that the majority of the new hams are at least high school graduates and many college graduates so they have had the necessary math education to work with the modern day solid state articles that all the ham magazines are putting in their magazines these days.

Many of the old time hams here in this city have let their subscriptions expire for this very reason. I and a lot of the old timers here have been tired of all the 2 meter FM that has been put in your magazine recently. I, for one don't give a damn for 2 meter FM. It gripes me to see all the guys setting on one or two frequencies in the middle of a big band like 2 meters with very little activity on each end from CW, AM and SSB. Remember, we lost the 11 meter band years ago the same way because we didn't use it, we hams only have ourselves to blame when we lose our frequencies. I do work 2 meter AM right now, had a 2 meter SSB, CW rig some years ago but sold it when I heard no one on CW or SSB here in the city.

I work all bands from 2 meters up to 160 at the present time, and work all three modes, CW, AM and SSB. I have always observed the so-called gentlemen's agreement and worked the proper mode in that portion of the band.

I have, in my library, my prize collection of magazines that you published when you were with CQ, many years ago. I would not part with them at any price.

I only wish that you would publish your present magazine with the variety of articles like you did then. Let's have an occasional tube article, more antenna articles, something on 160 more often and an occasional RTTY as I am getting set up on RTTY rather than 2 meter FM.

I still think you have the best magazine of the 4 and I get them all, so keep up the good work and remember us old timers with an article at times and include a solid state directory for the benefit of myself and the priest who don't know the difference between a TTL and a DTL or a CMOS.

I'll be retiring in a few months, so will have more time to experiment and build, providing I know what I am doing. I have faith in the future of

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your magazine, as you will note with the enclosed mailing label. I think my subscription is paid till January 1978 if I can figure your code right. In closing, my best regards to you and your family and staff at 73 for the coming year.

. . . William H. Toben W7JGL

All right. Let's have some articles of the type Bill suggests and we'll try to publish one or two a month. . .Wayne

REFORM OR DIE!

Today I received the December issue of 73 and, as usual, dropped everything else to read it. Totally irresponsible but absolutely pleasurable! I am one of those readers who tends to read the magazine from the back to the front and therefore read Commissioner Robert E. Lee's remarks last. Were it never true before, I can honestly say that this was one time when I read the best of 73 last.

While in college at Purdue University I got interested for the hundredth time in *A*mateur *R*adio (Commissioner Lee is right: Capitalize it as a measure of respect!) and through the Purdue club got my Technician's ticket (WB 9 EUV). To celebrate this accomplishment I subscribed forthwith to a lifetime subscription of 73 (boy, that's got to be the absolute best financial investment I've ever made – if I could apply that kind of wisdom to the stock market, I'd rule Wall Street!). However, since graduation in January, 1972 I set aside Amateur Radio to pursue my career. Several times I've started to renew my love affair but the thought of the Morse Code requirement for the General ticket repulsed me. Thus the text of Commissioner Lee's speech hit a nerve. Your own comments on page 124 also drove right to the quick.

The Amateur Radio Service in the United States, while serving without equal, is slowly dying. For years the established clique of ARRL, FCC, et al has prevented removal of a code requirement or a stipulation of a 5 wpm requirement for the General Class. Comes now the "new breed" in the personage of yourself, Commissioner Lee, and others who wish to rejuvenate the ranks. In the pages of your magazine we find such radical talk as needing to recognize CBers, etc. God, has this been a long time in coming!

There are those amongst us who will, with brazen stupidity, unmitigated gall, and unthinking selfishness, condemn these fine proposals, insisting instead upon the "purity of the past." These advocates stand a very strong chance of being the pall bearers of the Amateur Radio Service if their protests go without counter and defeat. This is 1974 and if Amateur Radio is to succeed it must streamline itself and redirect its path. Yes, take a lesson from the Japanese. Innovate, create, perpetuate! If, failing this, our leadership continues along the channel of antiquity, then surely the wings of the U.S. Amateur Radio Service will beat no more! If we must remove or modify the code requirement to attract new members to the ranks, do it! If we must join hands with CBers in the interests of the common good, do it! If re-allocation of frequencies is necessary, do it! Do these things and thousands of others. Let the readers of 73, CQ, QST, etc. join together and DEMAND that their editors aggressively act to bring these changes. Let the readers DEMAND that said editors JOIN TOGETHER (God, would that be refreshing instead of the incessant bitching) with men such as Commissioner Lee and those principals in the Citizen's Band community to enact immediate changes! Give our ranks 500,000 youth and then damn the torpedoes – full speed ahead.

Let us be as adamant about this, our greatest problem, as we are about the IRS, gasoline prices, and the cost of decent housing. We are a MINORITY. Take a lesson from other minority groups. Find strength and action through unity. Find despair and hopelessness through the plaintive cries for reform of the solitary and the foolish regressions of the "leaders" who have assisted us in reaching the point at which we find ourselves now. Change the rules, change the face of Amateur Radio, do whatever is necessary, but do NOT let this lovely mistress die! For she wears the face now of the great ships of the Cunard line who, like us, have no more places to go. True tragedy!

Can we, in closing, say "good luck"? Hell, no. Let instead the scream "Reform or die!" echo through the hallowed halls. Stop the infighting. Write your bloody Congressman and insist upon reform. If you don't think that 50,000 letters to the men in the Sam Rayburn building, etc. won't get some action, then there is no hope. Don't buy that new rig until you've spent 10¢ on a postage stamp and sent your feelings to Washington. Amateur Radio could change completely in 6 months. Or never. R.I.P.

. . .Richard M. Bash

Thanks for the nice letter Dick. There's no doubt that the ham magazines could help amateur radio enormously if they could cooperate. Someday, I suppose, the inside story of the schisms within the ham publishing industry can be written – but for the present it would be an understatement to say that they seem insurmountable. 73 Magazine is ready, at any time, to cooperate to the fullest with the other publishers for the betterment of amateur radio.

. . . Wayne

AND FURTHERMORE . . .

In reference to my article on the R-392 in the August, 1974 issue, here are some corrections:

R2 is 4700 Ohms one Watt.

C2 is across ZD1.

Q1 is mounted on the chassis with a mica washer.

Q2 is mounted on the HEP 500 heat sink with a mica washer.

I apologize if I have caused your readers any inconvenience.

. . .W7UGV

UTICA 650A?

I am in need of some critical info. I am the owner of a "Utica" model "650A" 6 mtr am xcvr. This is now a defunct company. I need a schematic for this rig and I cannot find one locally. Could you, or one of your readers furnish me a copy of this item. If absolutely necessary, I will pay postage for the mailed drawing. Thank you from a loyal subscriber.

. . . John T. Carrigan, Jr.
WB4PES

WE'RE GLAD TO HELP

The novice course seems quite good (the parts I've had a chance to listen to) and the approach of explaining the ideas behind the questions instead of just dwelling on the questions themselves is very constructive.

Thank you for making these useful things available at a very fair price. I am positive that many people will be able to get into amateur radio that would not be able to do it the misdirected ways available in the past. I remember how hard it was for me to get even basic information on what to do when I did it 15 years ago.

. . .Ron Gunn WA6KLL

SOCIAL EVENTS

SAYREVILLE NJ
MAR 2

First annual electronic flea market of the Raritan Bay Radio Amateurs will be Sunday, March 2, 11 am at the Sayreville Community Center (Old VFW Hall) Dolan Street, behind Sayreville Municipal Bldg. 50¢ at the gate, $5 per table. For information contact WA2SAJ (Rick) or WB2OVI (Alan). Talk-in on 146.52, .76, .94.

ON-THE-AIR
MAR 8-9

We hams like to think of ourselves as communicators, but just what is it that we communicate? If we're honest, we'll admit that all too often it's trivia. During the weekend of March 8-9 there will be some communications of substance. These are messages which concern the future of our planet from some well known people into economics, ecology, energy and other fields; and some little known people involved with home brew approaches to designing a better future. Ron Wilbur K6ZEZ came up with this idea of a "Futures Hamfest" where we could listen to and talk with these folks via ham radio from our own shacks. Most of the action will take place on 7175 mornings, 14234 afternoons, and 3849 kHz both evenings. Generals will be able to call in on frequencies exactly 100 kHz higher, with comments and/or questions. Illustrations, when used, will be transmitted via SSTV. Come join us.

Cop Macdonald WØORX

ROCK FALLS, ILL MAR 9

Sterling-Rock Falls Hamfest will be held March 9th. For info write Donald Van Sant, 1001 9th Ave., Rock Falls, Illinois 61071.

PARMA, OHIO
MAR 14

Spring ham gear auction sponsored by the Radio Club of Parma. Inspection 7:30 to 8:00 pm, auction 8:00 until at least 11:PM. Located in the basement of the Cardinal Savings and Loan Bldg., 5839 Ridge Rd., Parma, Ohio. Bring gear to sell, find some goodies you need. 10% commission charged on items over $2.50, 25¢ flat rate on anything under.

BERRIEN SPRINGS, MI
MAR 15

Blossomland ARA Hamfest will be held at the Berrien Co. Youth Fairgrounds. Advance registration $1.50, $2.00 at the gate. Indoor tables $1.00. For info write BARA Hamfest, P.O. Box 175, St. Joseph, MI 49085.

HANCOCK MI
MAR 15

The Copper Country Radio Amateur Association will be having their annual Ham Radio Auction on Saturday, March 15, 1975 in Hancock MI. Everyone is welcomed. Talk-in on 3.922 MHz and 146.94 MHz. 2-meter repeater will be 146.28 MHz-IN; 146.88-OUT.

STUART, FLORIDA
MAR 15

The Martin County Amateur Radio Assn. will sponsor a hamfest Mar. 15th from 9 am to 5 pm at the Tri-County Rehabilitation Center, 4461 S. Federal Hwy, Stuart, Fla. Prizes every hour, refreshments, exhibits, swap shop, etc. Talk-in 3.950, 146.94/94. For info write E. K. Shinn, 2089 N W Pinetree Way, Stuart, Florida 33494 or call 283-5210 or 334-4455.

WHITEWATER, WIS. MAR 16

The Tri-County ARC Midwinter Swapfest is March 16th, 9 AM to 5 PM at the National Guard Armory, Whitewater. $1.50 advance, $2 at the door (additional $1.50 reserves one displatable). Advance tickets eligible for special prize. Talk-in on 94. Refreshments, free parking, everything indoors. For tickets and details, Dan Servais, WA9AJW, Rt 4 Box 309AA, Elkhorn, Wis 53121. Tel 414-723-2227.

SILVER SPRING MD
MAR 16

Sunday, 9-4 indoor electronic swapfest, rain/snow/shine, Whiteoak Armory, East Randolph Rd, 1/4 mile East of US29, Silver Spring MD. Door prizes , refreshments, For info and adv. table reser. contact Mike Cox K3GEG. (301) 262-9640. Talk-in 16/76 – 94 – 52 and channel 10.

MIDLAND TX
MAR 23

St. Patrick's Day Swapfest beginning at 8:00 am in the Midland County Exhibit building 2 miles East of Midland on highway U.S. 90. Bring all your goodies, it will be bigger and better than ever.

CHARLOTTE NC
MAR 23

Metrolina Hamfest, Carolina Trade Mart, Corner of Stonewall and College Streets, 8 am til about 6 pm. Prizes and flea market. Sponsored by Mecklenburg ARS, Inc.

PATERSON NJ
MAR 23

The Knight Raiders VHF Club will hold their auction and flea market Sunday, March 23, 1975 at the YWCA, of Paterson, 185 Carol Street, Paterson, New Jersey. Free admission, free parking, refreshments available. Talk-in frequency 146.94 MHz. Flea market tables: $5 for full table, $3 for ½ table. Reserve your tables in advance by writing to: Knight Raiders VHF Club, Inc., K2DEL, P.O. Box 1054, Passaic, New Jersey 07055.

MALDEN, MASS
MARCH 29

The Malden Repeater Association will hold its auction on Saturday March 29 at 1 PM. It will be held in the rear room of A & W Electronics, 491 Riverside Ave., Medford, Mass. Talk-in on 19–79 & 52.

BROOKLYN NY
MAR 29-APRIL 6

The Radio Society of Greater Brooklyn will hold its first annual Worked All States Week Contest March 29 0001G to 2359G April 6. Winner will be the one to work all states in the shortest period of time. Anyone who works all states within the period will receive a certificate. Special certificate to the Novice who works the most states and operator working most states under most unusual conditions. Number of states only counts, not number of QSOs. Logs must include description of your station and the time, date, call and state of all stations worked. Any legal band, mode or power. Send logs to F. Grossman WB2BXO, 9519 Ave. M, Brooklyn, NY 11236.

TOWSON MD
APRIL 6, 1975

The Greater Baltimore Hamboree will be held at Calvert Hall College, Putty Hill and Goucher Boulevard, Towson, Maryland (one mile south of Exit 28 of Beltway-Interstate 695), on

Sunday, April 6, 1975 at 9 am. Food Service, Flea Market, Contests, Prizes. Registration: $2.00. Complete table set-ups indoors. INFO: Joe Lochte, 5400 Roland Avenue, Baltimore MD 21210 or Brother Gerald Malseed, 8102 La Salle Road, Towson MD 21204. (301) 825-4266.

JOHNSON CITY NY
APRIL 19, 1975

The Sixteenth Annual Hamfest, sponsored by the Southern Tier Amateur Radio Clubs, is scheduled for 10 am, April 19, 1975, at St. John's Ukrainian Hall, Johnson City, New York. Admission to lectures and flea market only, $1.00 for adults. Total admission, including awards and excellent dinner, $6.50. For tickets or further information, write to: STARC, P.O. Box 11, Endicott NY 13760.

COLUMBUS GEORGIA
APRIL 19-20

The Columbus Georgia Hamfest sponsored by the Columbus Amateur Radio Club will be held April 19-20, 1975.

Activities will begin with the flea market at 1 pm Eastern time. on Saturday and finishing with the main prize drawing at 2 pm Sunday.

For information and reservations contact Gary L. Kindred, 293 Nightingale Drive, Columbus, Georgia 31906. Phone 404 689-4494.

RALEIGH NC
APRIL 20, 1975

Third Annual Raleigh Amateur Radio Society Hamfest will take place all day Sunday, April 20, 1975, at Crabtree Valley Mall, Hwy 70-W, just west of the city. A covered flea market, bigger than ever; many great prizes; group meetings will be featured. General admission $2.50 ea. Food at reasonable cost. For flea market reservation and other info write: George Richards WA4EKJ, Chairman, RARS Hamfest, P.O. Box 17124, Raleigh NC 27609.

GRAND RAPIDS MI
APRIL 24-26

Grand Rapids Annual Communication Show and Swap 'n Shop. On the Mall exhibits April 24-26, 1975. Ham and Electronic Swap 'n Shop April 26, 1975. At Eastbrook Mall on East 28th Street (N.E. corner of M11 and M44). Contact Bob WN8PTM, P.O. Box 2402, Grand Rapids, Michigan.

AMBOY IL
APRIL 27, 1975

Rock River Radio Club Hamfest, Sunday, April 27, 1975. Same location as in past year's at the Lee County 4-H Club Center, Amboy, Illinois. 1 mile East of Junction Rt52 & Rt 30, South of Dixon, Illinois. Advanced Tickets $1.50. Gate $2.00. *Special* to April 1, 1975 4 tickets for $5.00. Rain or shine, indoor facilities, etc. Camping area. Limit 1 table free per party. Additional tables $5 each or bring your own. Talk-in frequency will be 146.94 mc.

DURHAM NC
MAY 17-18, 1975

Durham F.M. Association proudly presents its annual Hamfest, fleamarket and F.M. Convention, Saturday and Sunday, May 17-18, 1975. Downtown Ramada Inn, Durham NC. Advanced registration $2.00 – $3.00 at door. Children free. Saturday night banquet – res. $11.00. For info write: Durham F.M. Association, Inc., P.O. Box 8651, Durham NC 27707.

CONNECTICUT
QSO PARTY
MAY 3 to MAY 5

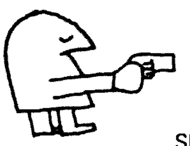
Contest period 2100 GMT May 3 to 0200 GMT May 5. Certificates to highest scorer in each ARRL section or Province and each Connecticut county. Special – Worked All Connecticut Counties certificate. Trophy to highest scoring club entry. For info write Candlewood Amateur Radio Assn., c/o Donald Crosby W1EJM, 10 Royal Rd., Danbury, Conn. 06810.

KNOXVILLE TENN
MAY 24-25

The Radio Amateur Club of Knoxville is pleased to announce that its annual Greater Knoxville Hamfest will be held again on May 24th and 25th, 1975. As always, the activities will be located in the Jacobs Building at Chilhowee Park, Knoxville. All activities, including the large fleamarket, will be held indoors, so inclement weather will be no problem. In addition to the fleamarket and various exhibits, we have an excellent zoo, amusement park, and overnight camp hookups right in the Park. No hamfest admission or registration charge. Table rental for fleamarket. Ticket donations for prize drawing on Sunday. Picnic Saturday afternoon. Talk-in on 34/94 and 3980. More info from WA4BTK, John Gwin, 1316 Kirby Road, Knoxville, Tennessee 37919.

CONTESTS

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952



APRIL 5-6
SP-DX CONTEST

From 1500Z April 5 to 2400Z April 6. 80 thru 10 meters CW. Work as many Polish stations (SP, SQ, 3Z) as possible, once per band. Call "CQ SP." Send RST and serial QSO nr. (E.g. 599001, etc.) SP/SQ/3Z stations will send RST and POWIAT abbreviation (e.g. 559AB, 379ZG, 549KC, etc.). Score 3 pts per SP QSO per band and multiply by each POWIAT denoted by two-letter abbreviation, but only *once* independently of band. Categories are single-op multi-band, multi-op multi-band, single-op single band (separately each band), and single-op listeners (SWL). Logs must show dates/times GMT, complete exchanges, summary sheet with all scoring info, category of competition, name and address, multiplier check list and usual declaration. Appropriate awards. Postmark deadline is April 30. Send to: SP-DX Contest Committee, P.O. Box 320, 00-950 WARSZAWA, POLAND.

RESULTS
1974 WASHINGTON
STATE QSO PARTY

Top five Wash. – WA7SLO, WA7UQG, K7RSB, W7YTN, K7KGP.

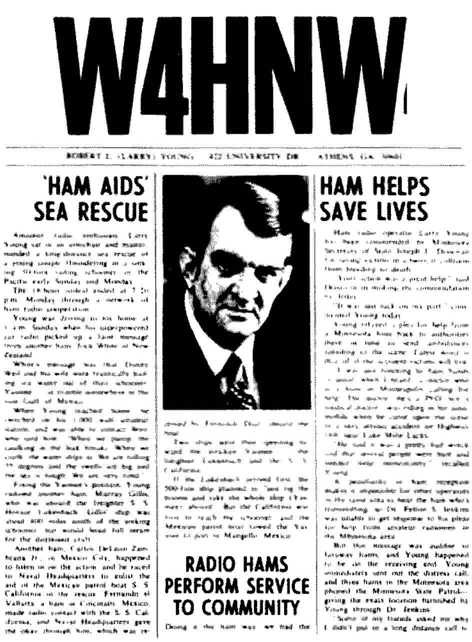
Top five non-Wash. – WB4YPT, W7RIR, K4ZGB, W4UPJ, K6WT.

Sponsor – Boeing Employees' ARS.

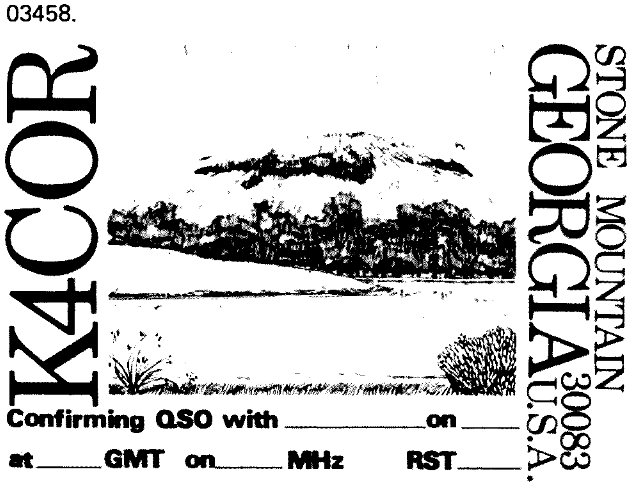
REMINDER: Send all info on contests to the above Steubenville address 3 months prior to the date of the contest. Thanks.

...WB8KZD

QSL CONTEST: GEORGIA PEACHES



These two beauties got moved to the middle of our March wallpaper at the same time, so it looks like we're stuck with sending out two free subscriptions this month. Larry Young's eye-catcher goes the PR route – one that should be traveled more by us all – while Alan Pike's pen-and-ink of Stone Mountain really stands out on the shack wall. Congrats and a well done to both W4HNW and K4COR, and a reminder to all inside and outside the great State of Georgia that entries should be mailed to 73, QSL Contest, Peterborough NH 03458.



HAM HELP

Helpers: Times are tough all over, but remember when you were just starting out? Brighten one of the following's ham day by getting in touch and lending a hand. Preserve the race!

Helpees: Don't be bashful. Drop a postcard to 73, Ham Help, Peterborough, NH 03458.

Sid Blumner
9425 Ramona Avenue
Montclair CA 91763
714-626-6447

Candace M. Vorpahl
1508 S 92nd St. Apt 16
West Allis WI 53214
414-476-8755

J. E. Stewart Jr. WN2UTF
Mileses NY 12761

Kevin derKinderen
38 Great Republic Avenue
South Weymouth MA 02190
617-335-5259

Ed Wilkening
900 E. Manitoba
Ellensburg WN 98926
Tel No. (509) 925-2407

Bill Fletcher
1230 Hiawatha Drive
Beaver Dam, Wisconsin 53916

LeRoy Davis Jr.
1117 Clagett Drive
Rockville, Maryland 20851
301-762-3425

Preston E. Koelling
P.O. Box 428
Webb City MO 64870

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

SALE: Heathkit HW 202 FM transceiver with tone burst and ac supply. Factory serviced. $185. Alton Dwight Sunday 708 Langrick St., Sturgis MI 49091.

COLLECTOR is interested in books, autographs and other information on early radiotelephone pioneers. Ronald Phillips, 1925 Baltimore, Kansas City, Missouri 64108, (816) 842-9009.

COLORADO HAM directory. Over 4,000 listings by call, name and zip. Also lists Colorado repeaters and nets. $2.50 ppd. from the Colorado Council of Amateur Radio Clubs, Box 242-A, Longmont, CO 80501.

CMOS INTEGRATED Circuits. While they last. Guaranteed, tested. 1103 $2.89, 4011 39¢, 4049 89¢, 4116 99¢, Dual NPN like 2N4880 47¢, many more types. Postage free with $5 order. Electronic Product Associates, Inc., Box 80341, San Diego CA 92138.

TRADE HANDI-TALKIE Regency HRT-2, new, never opened, for any interesting solid state gear. WØKGI (303) 447-8692 (Colorado).

AMSAT/OSCAR 6-7 slides – set of 5, $1.25 lift-off and equipment. Proceeds AMSAT. K6PGX, P.O. Box 463, Pasadena CA 91102.

TALLY SYSTEM 1020A Digital mag. tape deck. Perfect for mini-micro computer systems. 2 manuals – full spare parts included 140,000 8 bit or 5 bit word capability complete with control panel and power supply, fully operational – new condition. First $350.00 takes it. R. McCulla K7HBG, 20333-15 NE #28, Seattle WA 98155.

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester, NY 14612.

R-390A/URR – like new, recent overhaul, with books and connectors. $550, pick-up only. WA1TEJ, 31 Kern Drive, Nashua NH 03060.

AN/URA-8B – like new, complete dual-diversity RTTY audio-type TU set (2 each CV-89A/URA-8A converters, CM-22A/URA-8A comparator, MT-719/URA-8A cabinet, connectors and book). $350, pick-up only. WA1TEJ, 31 Kern Drive, Nashua NH 03060.

TT-63A/FGC – Excellent RTTY regenerative repeater with book. $25, pick-up only. WA1TEJ, 31 Kern Drive, Nashua NH 03060.

AN/FGC-20 – Kleinschmidt TT-100/FG teleprinter, like new, with table, copywinder, 60, 67, 75 and 100 gears, book. $150, pick-up only. 31 Kern Drive, Nashua NH 03060. WA1TEJ.

AN/FGC-25 – Kleinschmidt ASR, like new, complete with table, printer and printing reperf, 3 books. $200, pick-up only. WA1TEJ, 31 Kern Drive, Nashua NH 03060.

COMPLETE RTTY receiving set-up as listed individually above, plus 170 HZ AFSK board, 19" relay rack, RTTY manuals, cables, etc. $1,000, pick-up only. WA1TEJ, 31 Kern Drive, Nashua NH 03060.

AN/APX-6 and late AN/APX-6B 1296 transceivers, unmodified, one less tubes, with mobile omnidirectional antenna. $50, pick-up only. WA1TEJ, 31 Kern Drive, Nashua NH 03060.

DIODES, Mallory 2½A, 1000V. 10/$2.00, 50/$8.00, 100/$15.00, 1000/$120.00 BECO, Inc., Box 686H, Salem, VA. 24153.

SELL: Motorola 60W desk top 3 channel on 2M. GE pocketmate on 94 manual. Best offers. Vernon Fitzpatrick, WA8OIK McLain Park, M 203 Hancock MI 49930.

COMPLETE 5-Band SSB Station. Central 20A XMTR w/VFO; Heath HR-10B RCVR; Antenna Tuner w/SWR, Mic, Key, Phones; $150/offer; Carey Witkov 9110 LaCrosse Skokie, Ill. 60076.

PC Boards, from magazine page; original; magic marker; art, 1/2:1-1:1-2:1 Scale size. $3.30 up. BECO, Inc., Box 686H, Salem, VA. 24153.

AUTOMOTIVE Voltage Regulator Kit, IC Construction, (PE April 1971) RFI Free, $16.95 – $19.95. BECO, Inc., Box 686H, Salem, VA. 24153.

FOR SALE: R-390 receiver $100.00; 30 watt 6 meter Motorola transceiver $25.00. WA1QKQ, 18 Clearview Ave., Lynn MA 01904.

WANTED: Hallicrafters T-54, early 7-inch TV receiver in metal cabinet with push-button tuning. Any condition, including parts only. Also manufacturer's service manual (not Photofact). Please write the description to: C. H. Sarver, 6011 N. River Rd, Waterville, Ohio 43566.

VERMONT HAM Paradise for rent May-October. New six bedroom chalet S. Londonderry, Vt, Windham County, complete with Drake kilowatt station 80-10, Tower and Tribander, near lakes, theater, shopping, antique auctions, tennis, elevation 1200 feet available by week, month or season. Peter Sherry K2AUO. (212) 532-5047 or Box 194 S. Londonderry VT 05155.

MOULTRIC AMATEUR Radio Klub 14th annual hamfest, April 27, Wyman Park, Sullivan. Indoor, outdoor market. Tickets $1. Advanced $1.50 at gate. Write Mark, P.O. Box 327, Mattoon IL 61938.

HEATHKIT HD-15 phone patch, mint, $30; Westinghouse 3" reel tape recorder & 4 tapes, needs some work, $20. Richard Morofsky, Box 11, Nemacolin, Pennsylvania 15351.

DECORATE YOUR SHACK. 2X3 ft. Vinyl backed washable polyster mat with "AMATEUR RADIO" and your call. In red, green, gold, or blue with black letters. Enclose $15.95 plus $2 shipping and handling. Georgia residents add 3% tax. BankAmericard or Master Charge accepted. Ringo Sales Co., Box 577A, Ringgold, GA 30736.

CLEGG, SWAN, CushCraft at prices I dare not publish. Call or write WØNGS, Bob Smith Electronics, 1226 9th Ave., North, Fort Dodge, Iowa 50501. (515) 576-3886.

VACATION LAND HAMFEST Sunday May 18, 1975; Erie County Fairgrounds near Cedar Point. Huge flea market area. First prize – Regency HR-2B. Tickets $1.00 advance, $1.50 at gate. Information: Hamfest, P.O. Box 2037, Sandusky, Ohio 44870.

DRAKE TR-4, MS-4, AC-4, DC-4 Mint condition. $450.00 or best offer. Knud E. M. Keller, RT 12 A, Surry, NH 03431.

Continued on page 32

CAVEAT EMPTOR from page 31

ATTENTION DXers! Ham sentences written in 54 languages get DX QSLs. Use K3CHP's DX QSL GUIDE. $3.95. Joe Mikuckis, 6913 Furman Pkway., Riverdale, MD 20840.

FREE: 12 extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Collins, Ten-Tec, Kenwood, Swan, Atlas, Standard, Tempo, Clegg, Icom, Genave, Midland, Alpha, Hy-Gain, Mosley, CushCraft, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. #25, Box 403, Terre Haute, Indiana 47802. (812) 894-2397.

MIDLAND 30 Watt 13-505 w/.94, .34, .76, .88, .85, .82, .52 and 5/8 wave ant – $250, HWIZA, new HP13B, Hustler Ant & chain mount, good mike – $165 – W9DSV, 21 Britton Dr., Hudson FL 33568. (813) 868-3991.

CLEANING OUT shack for fun and profit! All types of equipment for sale at hamfest prices including CW, SSB, ATV, SSTV, RTTY, FM, HF/VHF/UHF and even radar as well as station accessories, antennas, and test equipment. A huge assortment of tubes, vacuum variables, meters, capacitors, transformers, blowers, resistors, relays, high power components, and other rare goodies too numerous to mention. Send large S.A.S.E. for list to: WA8ONQ, 311 N. Marshall Road, Middletown, Ohio 45042.

WANT SIGNAL ONE CX-7 working or not, will trade my new TS-520 up or down. Need 3-400z or 3-500z. Pohorence, 2334 Regal Court, Lawrenceville GA 30245.

FOR SALE: Swan 250, 117XC. Excellent $300.00. HT-37, P.T.T. VOX like new, manual $165.00. HA-2, P26, manual $175.00. Want LSB, CW, filter for TR-6. Call or write Jim W1VYB (617) 922-3850.

TECH MANUALS – $6.50 each: R-220/URR, URM-25D, USM-159, USM-16, PRC-10. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

AUCTION

Canton Amateur Radio Club, Friday, March 14, 1974 at 6:00 pm, check-in on 52 or 19 79. Imperial House at I-77 and Easton St., Canton, Ohio.

TWO-METER FM ANTENNAS, 1/4; 5/8 W "Cartop"; and Fixed Station. Unique designs. Send for literature. Marsh Devices, P.O. Box 154, Old Greenwich, Connecticut 06870.

SELL J&R SSTV, Yaesu 400 S.D. rcvr, 400 xmtr, F.T.V. 650. Other priced to sell. (304) 478-2270 evenings. SASE – List. Box 326, Parsons WV 26287.

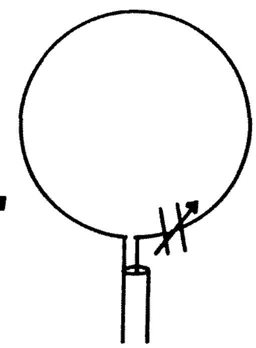
RADIO EXPO 75: September 6&7, Fairgrounds, Grays Lake Ill. Seminars, fleamarket, manufacturers' exhibits, camping. Information: Write EXPO, Box 1014, Arlington Hts., Il 60006.

COLLECTOR is interested in books, autographs and other information on early radiotelephone pioneers. Ronald Phillips, 1925 Baltimore, Kansas City, Missouri 64108. (816) 842-9009.

WANTED old radios and radio items. Also old toy trains of all kinds. Want viking KW Desk Amplifier – mint. W2GHF, 45 Allen Dr., Woodstock NY 12498.

J. Malone WØPJG
Department of Chemistry
University of California, San Diego
La Jolla CA 92037

Can A 7 foot 40m Antenna Work?

. . . the Small Lop

In attempting to operate an amateur radio station while living in an apartment on the top floor of a three story frame house, it was desirable to use the smallest antenna possible. Since in the interests of social harmony it was virtually mandatory that the antenna be concealed from the landlady who lived one floor below, the antenna had to be restricted indoors to the confines of the apartment. In the course of trying to match a number of different shapes of wire to a coaxial transmission line it was noticed that when the loop forming the gamma match in the center of an 'S' shaped antenna was made large enough, a close match to the transmission line could be obtained. While the first surprise was that the loop forming the gamma match was as large as it was, the second was that the match to the line was little affected when the arms of the 'S' were shortened and even removed. That the loop that remained was of a useful size for an antenna was evident since at 7.15 MHz the length of wire in the loop was about 6.7 meters (22 feet) and the total height when erected vertically was about 2.1 meters (7 feet). An antenna this size was easily manageable while there was simply not enough room to put up a half wavelength antenna 20 meters long.

At first it seemed to be a bit strange that a loop antenna this small would have as high a radiation resistance as it did. In a number of books the radiation resistance of a loop antenna with a uniform current distribution is calculated (as in ref. 1) and a loop with a circumference of about .7 wavelength is needed to obtain a radiation resistance of 50 ohms. Since this would mean the calculated loop circumference would be some 4.5 times the actually measured size a qualitative check was made of the current distribution in the loop. As can be seen in Fig. 1, the current distribution was certainly not uniform. Indeed it was not even symmetric about the two points where the antenna was fed; a much greater current flowed in the side connected to the capacitor. This held true with the connections to the coax braid and center conductor switched. Once it is established the current is not uniform it is to be expected that the radiation resistance will be higher than the uniform current model would predict. Thus it appears that a more accurate physical model would have to be used to explain why the current flow assumes the form it does. (These measurements are not precise but are probably accurate enough to ascertain the antenna current. They were made with a loop of wire a couple inches in diameter held several inches from the antenna. This test loop and a four germanium diode bridge were mounted on the end of a four foot piece of plastic pipe and the dc output was fed through a coax line to a galvanometer.)

It needs to be said that the above mentioned and all the following measure-

ments were made with the antenna indoors on the ground floor of a two story frame apartment building in San Diego, California. The concrete floor, which is essentially at ground level, was covered with at least two layers of regular aluminum foil. This gave a solid ground plane roughly 6.7 by 4 meters and .0032 cm thick (which is about the skin depth of a 7 MHz rf current in aluminum). The antenna was made of 19 strands of aluminum wire in a loose bundle. Each strand was slightly less than 1/16 inch in diameter. The antenna was erected in a vertical plane and fed with RG-58/U at its lowest point which was 20 cm (8 inches) above the ground plane. The ground plane was not directly connected to the antenna, feed line or signal source. A Galaxy V transceiver was used as the rf source and the swr readings were taken on the swr meter in a Galaxy Deluxe Accessory Console which gave a 1.0 to 1.0 reading for a 51 ohm load. The antenna was about 3.5 meters from the transceiver.

The small loop antenna, as might be expected, is inductive and from Fig. 3 it can be seen that the inductive reactance increases as the length increases. This can be

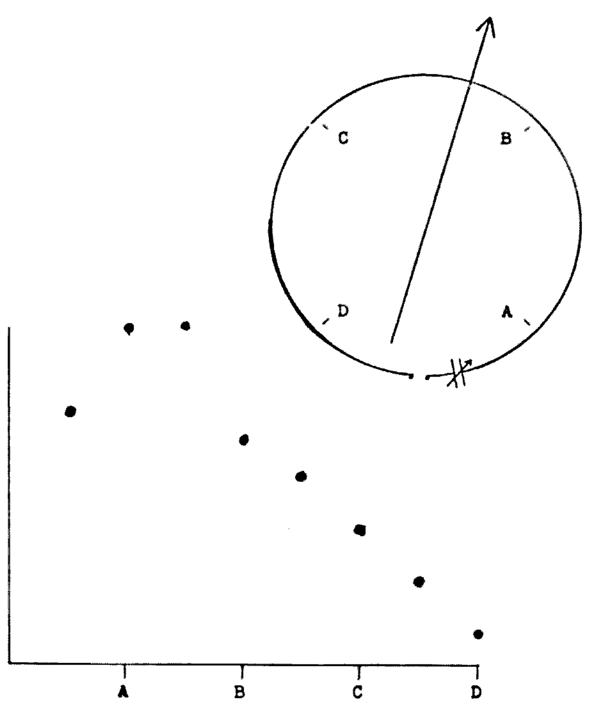


Fig. 1. A plot of the approximate current flowing in the antenna. Current is plotted on the vertical axis in arbitrary units. The slanted arrow indicates the general radiation polarization of the antenna positioned as shown.

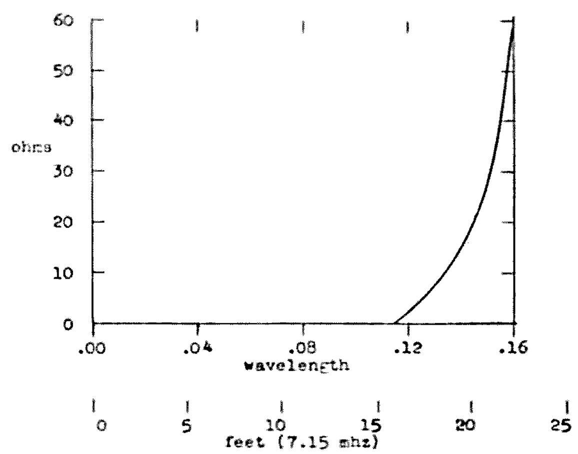


Fig. 2. The radiation resistance of the loop antenna versus the length of the circumference measured in fractions of a wavelength. The bottom scale gives the circumference in feet for a signal frequency of 7.15 MHz.

contrasted with the short linear dipole which looks capacitive and whose reactance goes to and crosses through zero as its length is increased. The radiation resistance of the loop as a function of its length is given in Fig. 2. Comparing the points on the graphs where the radiation resistance equals 51 ohms it can be seen that the reactance is almost eight times as large as the resistance which indicates that the setting of the capacitor in series with the antenna will in practice be critical. Adding to this problem is the very rapid change in resistance as the length increases, which indicates that the length of the antenna will also be a critical factor. Experience confirms that only small variations in the length and in the capacitance can be tolerated if a close match to a transmission line is sought. These readings were taken at low power with a calibrated 100 ohm carbon potentiometer inserted in series between the coax inner conductor and the variable capacitor.

The swr of the loop antenna across the entire 40 meter band is shown in Fig. 4. Here the length of the antenna and the setting of the capacitor were chosen to give the best match at 7.15 MHz. As can be seen the swr is less than 1.6 to 1 even at the band edges. In Fig. 5 the length of the antenna was not changed but the capacitor was adjusted to give the lowest swr at each frequency. One can see that for a fixed length the antenna can be tuned to keep the swr below about 1.2 to 1 even at the band

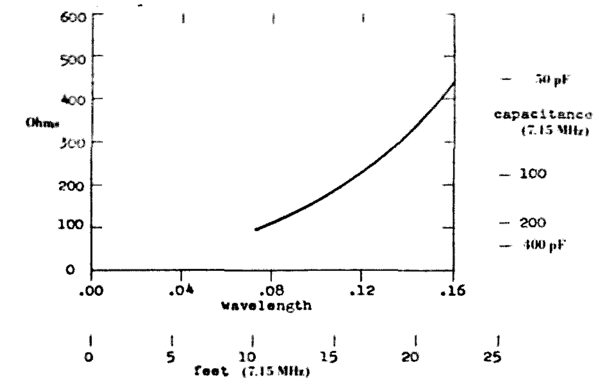


Fig. 3. The inductive reactance of the loop antenna versus the length of the circumference. The scale on the right indicates the value of the series capacitor needed to tune out the antenna's reactance for a signal frequency of 7.15 MHz.

edges. In Fig. 6 swr plots are given for several different capacitor settings.

Some Important Practical Aspects of Small Antennas

While a loop antenna that is .05 wavelength high can radiate as well as any simple dipole antenna, there are a number of very important practical considerations that have to be kept in mind. Indeed, these considerations apply to any short antenna whether it is a dipole, loop or whatever, even though the discussion here will focus on the loop. The first concern is with tuning out the reactance and obtaining the proper radiation resistance while the second involves minimizing nonradiative energy losses.

1. Tuning out the reactance and obtaining the proper radiation resistance.

Most short antennas will be reactive and the loop is especially so. For maximum operating efficiency in most situations, it is desirable to have the feedline see a purely resistive load. It is also usually desirable that this resistive load be of a particular value. Since in most short antennas a small change in the length will have a profound effect on both the resistance and the reactance, the length has to be determined rather accurately. One difficulty here is that the "right" length is going to depend on such things as the proximity of conducting bodies, antennas, feedlines, towers, etc., as well as the height above ground and the nature of the ground itself. The reactance needed to tune the antenna will be similarly affected. What this means in practice is that the length of the antenna and the value of the tuning reactance will have to be adjusted in each situation to make sure a reasonable match is being obtained. Thus it is essential that an swr meter, antenna bridge or other accurate device be used to determine that the antenna does indeed provide a close match to the feedline being used.

In connection with tuning the antenna there is another detail to consider. Since the loop antenna has much inductive reactance, the capacitor used to tune it will also have a high reactance which means that the voltage appearing across the capacitor will be large. For the loop antenna under consideration here it means that 100W of rf fed into a 50 ohm loop will produce about 800V peak across the capacitor, which indicates that even at this power level there are few capacitors other than air or vacuum dielectric ones which can be used that will not arc through or burn out. For an rf power level of 2 kw PEP into the loop it means that something like 3600V appears across the plates, which indicates that the capacitor will have to be chosen with some care.

2. Minimizing nonradiative energy losses.

In principle the ability of an antenna to radiate does not change as the antenna is made smaller since the current goes up as the length is reduced. The problem is that as the current rises the energy lost to heating the antenna wire increases as the current squared so that what may have been built to be a

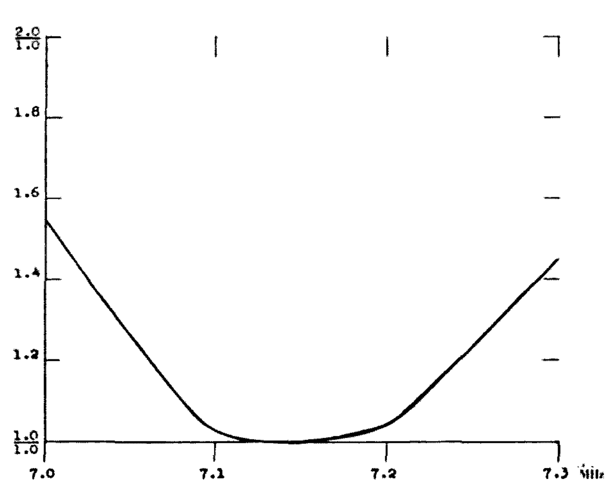


Fig. 4. The swr of the small loop antenna across the 40 meter band. The antenna was matched to a 51 ohm coaxial transmission line at the band center.

small antenna may in fact be a big resistor that generates a lot of heat and radiates little rf. If the probably not unreasonable assumption is made that the loop antenna electrically looks like an antenna that is .05 wavelength high with a nonuniform current distribution then the antenna has an intrinsic radiation resistance of about ½ ohm. This low value should not be confused with the much higher resistance presented to the feedline. In order that at least 90% of the energy be radiated this means the antenna wire has to have a circumference of about 4cm or, for a single conductor, a diameter of about 1.3cm (½") at 7MHz. All that is important is the effective 'surface area' of the conductor. The thickness can be quite small since a flat strip of aluminum foil that is four layers thick and 2cm (¾") wide is sufficient. If a small antenna is constructed by joining sections of tubing or wire or whatever together then care must be taken to insure that the joints do not constrict the diameter enough to create points of high resistance and accompanying high heat loses.

The second source of nonradiative energy loss that affects every antenna, regardless of its size or type and in almost all locations, is the heating of the ground near the antenna. This subject is somewhat involved and will be mentioned only briefly here even though ground losses are probably the major limiting factor on the lower ham bands in most amateur radio stations. The less the height of an antenna the greater the ground losses are. Indeed, for antennas close to the

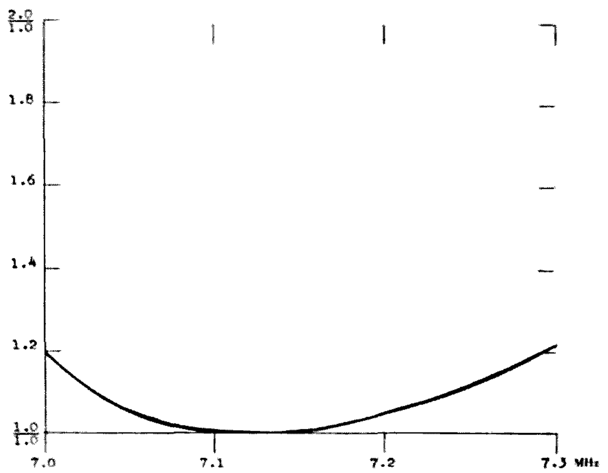


Fig. 5. *This is the same plot as Fig. 4. except that the series capacitor was adjusted to give the lowest swr at each frequency.*

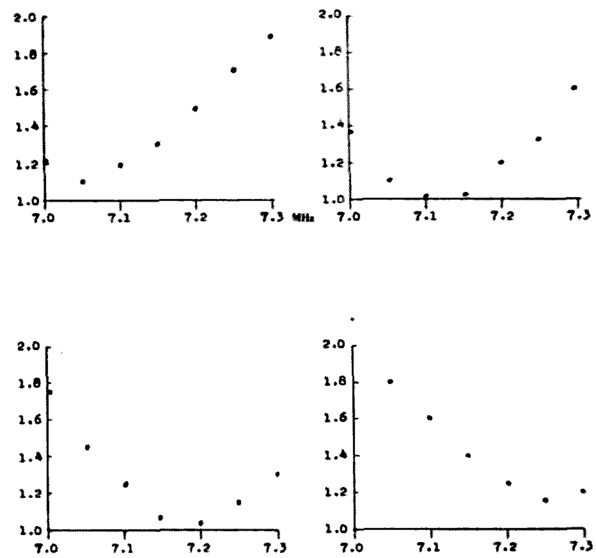


Fig. 6. These plots are the same as Fig. 4. with the exception that each one was made with a different setting of the series capacitor. The antenna length remained fixed.

ground surface, the ground loss is horrendous and only a small fraction of the rf fed to the antenna is radiated. Ground losses can, however, be greatly reduced and such low antennas can be highly efficient radiators if an adequate ground system is used. While the size of the ground system needed will depend on such factors as the ground conductivity, the height and size of the antenna and the frequency, a minimal system might consist of 100 wires each a quarter wavelength long shallowly buried in a radial pattern. An indication of what can be achieved when ground losses have been reduced to a low level is given in ref. 2.

The aluminum ground plane used here with the 7 MHz loop antenna should be about as efficient as an extensive wire ground system of the same dimensions (6.7 by 4 meters). Assuming a local ground conductivity of 15 millimhos per meter (ref. 3), a rough calculation adapted from ref. 4 indicates that, neglecting wire losses, the efficiency of the antenna system is reduced by ground losses to about 35%. Thus about two thirds of the rf energy fed to the antenna merely heats up the ground near the antenna and is wasted; 35% is radiated to the atmosphere. Wire losses in the loop antenna itself may reduce this to near 30%. To

compound the losses a bit further, if the final amplifier in the transceiver used here is assumed to be about two thirds efficient, then a dc input power of 200W to the final amplifier finally results in all of about 40W of rf being radiated to the atmosphere – this is an overall efficiency of about 20%. Without the ground plane the losses would be expected to be much greater than they already are.

Some Results

That the loop antenna works even with a not overly efficient ground plane can briefly be indicated with the operating results obtained on the 40 meter CW band the first couple of nights the antenna was used in San Diego. In addition to a number of closer contacts, QSOs were readily started with east coast, midwest, Canadian and Hawaiian stations. That QSOs resulted from a healthy proportion of the CQs that I responded to was personally satisfying considering that 200W of input to the final was feeding an antenna seven feet high whose base was virtually sitting on the floor of my living room. In addition, the building is located in a shallow canyon which raises the lowest possible radiation angle a number of degrees above true horizontal.

Some Possible Uses of a Short Antenna

As discussed above, the small loop has two disadvantages relative to a conventional full size dipole. First it has to be constructed of a much larger wire size to minimize resistive wire losses. Second it has to be tuned fairly accurately – both the length and the series capacitance have to be within narrow tolerance limits. In addition, the capacitor has to have a hefty voltage rating which for many hams means using a suitable air or vacuum capacitor or a section of coax trimmed to the proper length. In practice, once they have been recognized, the disadvantages can be readily overcome, giving the user a small antenna that can be expected to work much the same as a regular dipole with the same orientation at the same height.

Since the 7 MHz loop is about 7 feet in diameter it is possible to construct it of a self supporting conductor such as copper or aluminum tubing or fairly stiff ¾" diameter coax and to suspend it from a single support. It could, for example, be mounted instead of a center supported horizontal dipole or inverted V. The loop has the advantages that no end supports are needed and that it will usually be possible to orient it as desired instead of orienting it to fit space limitations. The loop also possesses the unique advantage that in such an installation it can be orientated to radiate vertically; it should work much as would a vertical dipole whose center was as high as the center of the loop.

Table I

Amateur Band	Loop Circumference	Series Capacitance	Conductor Diameter
160 meters	88 feet	200 pf	1.0 inches
80	44	100	.7
40	22	50	.5
20	11	25	.4
15	7.3	12	.4
10	5.5	6	.3

Approximate loop circumferences, tuning capacitances and minimum conductor diameters (if a single round conductor is used) for the lower ham bands.

In choosing a particular orientation it should be noted that in Fig. 1, with the antenna fed at the bottom, the orientation of the radiated rf will be mostly vertical with a sizeable horizontal component; it looks like a tilted vertical. For true vertical radiation it will be necessary to rotate the loop, capacitor and feedline counterclockwise. A suitable clockwise rotation will make it radiate like a horizontal dipole. It will also radiate horizontally if the plane of the loop is parallel to the ground. In many installations it will be possible to erect two or even three loops so the operator has a choice of polarization.

In addition to being usable where space limitations rule out a full size dipole, the small loop antenna lends itself to emergency and portable operations. If erected close to the ground without an extensive ground system, it can be expected to work as badly as any other antenna at the same height, although there are many situations in which such performance is adequate. The loop is a lot smaller than a full size dipole and it can be oriented to radiate vertically or horizon-

tally. As indicated in Fig. 4, it can be constructed to cover a fairly wide range of frequencies and still maintain an acceptable swr. It might be noted that while the effect depends on the conductivity of the ground, the radiation resistance of an antenna that is not above an extensive ground system will be affected by the height above ground. As a rough figure, the effect can become important below a quarter wavelength and drastic below an eighth wavelength.

Table 1 gives rough length, capacitance and minimum single conductor diameter (for aluminum) for the lower ham bands. With aluminum conductors, either solid or hollow of the diameters given, the wire losses should be less than 10%. Losses in a copper wire of a given size should be about .8 times the aluminum losses. To obtain a suitable conductor it is possible to use two conductors with half the diameter, four conductors with a quarter the diameter, twenty conductors with a twentieth the diameter, etc., provided the wires are well separated from each other and not tightly bundled together. These numbers were obtained by scaling the 7 MHz results. If f is the frequency, the length and the capacitance are proportional to 1/f, while the conductor "surface area per unit length" is proportional to $1 \div f^{1/2}$. The exact length and capacitance values required may well vary with different installations and it is urged that, as with beams, quads, and many other antennas, the length of the loop and the series capacitance be adjusted for an optimum match to the feedline with the antenna at the intended height and orientation.

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The Secret of Antenna Gain (shhh-it's capture area!)

Aside from the mystery of words like *capture area, gain,* and *isotropic radiator,* the antenna theory they deal with is both interesting and useful to the amateur. This article describes some of the more useful aspects and shows how they apply to HF and VHF transmission of radio signals.

As a starter, let us assume that you have an antenna connected to a transmitter through a short length of 52 Ohm coax transmission line. Let us also assume that the antenna is perfectly matched to the transmission line, and the transmitter is also perfectly matched. Although we say that the coax cable has a "52 Ohm impedance", in the perfectly matched case it is actually a "resistive impedance", meaning that it acts like a resistance – the current and voltage at any point in the line are in phase with each other. This then means that the antenna looks like a resistive load to the coax – all the power leaving the transmitter arrives at the antenna (since we have assumed that the coaxial line is short so that it has no loss itself).

So what happens to all the power once it enters the antenna? Part of that power is radiated into space, while the rest is lost in the antenna as heat. In an efficient antenna, such as a half-wave dipole, most of the power can be radiated with relatively little power lost in heat. On the other hand, a shortened inductively-loaded vertical antenna such as a 20 meter mobile antenna is fairly inefficient, and so a large portion of the transmitter power is used to heat the loading coil, and therefore less power is left over to be radiated.

The Isotropic Radiator

The isotropic radiator is an imaginary antenna which satisfies two impossible conditions:

1) It is perfectly efficient – all the power entering it from the feedline is radiated, with none lost in the antenna itself.

2) All the power radiated is sent out into space equally in *all directions.*

The first condition can be approximated fairly closely in real life by using good conductors and an antenna design, such as a half-wave dipole, which does not have or need any external components such as loading coils or fancy coupling networks. But of course we cannot build an antenna which has no losses whatsoever.

It's the second condition, however, which makes the isotropic radiator impossible – all practical antennas have at least one direction in which there is no radiation whatsoever. This is caused by radio waves radiated from different parts of the antenna cancelling themselves out. In the case of the dipole, there is no signal (at least theoretically) coming off the ends of the dipole. And so there is no such thing as an antenna which radiates equally well in all directions; you simply cannot build an isotropic radiator.

Nevertheless, the isotropic radiator is a useful theoretical tool, since it provides a yardstick with which we can measure the performance of other antennas. To see how this is done, let us take a specific example

and juggle the numbers to see what we get.

Suppose we could get an isotropic antenna, connect it to a transmitter, and feed 100 watts of power into it. Call the transmitted power P_t, so that

$$P_t = 100 \text{ watts.}$$

Since an isotropic radiator is supposedly 100% efficient, all of this power is assumed to be radiated out into space. Assuming that the air around the antenna is clean and dry, so that no power is absorbed by moisture around the antenna, we could then build a large ball around the antenna, in the shape of a large sphere, and collect the transmitted power to get the whole 100 watts back. Practically, of course, this is silly, but theoretically it is useful.

As an example, suppose the ball has a radius of 1000 meters (to make the results come out in common units of measurement, it is necessary to use meters in these calculations). Since the equation for the area of a sphere is

$$\text{Area} = 4\,\pi\,r^2$$

where r is the radius and π the (the Greek letter pi) is 3.14159, we can calculate the area of our 1000-meter-radius sphere as

$$\text{Area} = 4\text{x}3.14159 \times (1000)^2$$
$$\text{Area} = 12{,}566{,}360 \text{ square meters}$$

(where "square meters" is often abbreviated as meters^2 or just plain m^2).

Since the isotropic radiator is assumed to radiate equally well in all directions, this means that each part of this sphere is getting the same portion of the total transmitted power. In other words, the 100 watts of transmitted power is spread out over the surface of the entire sphere, with each square meter of the sphere getting its share. We can calculate that share simply by dividing the total transmitted power by the total area of the sphere; this result is then called the "power density" which we shall indicate with the letter $\underline{p}$. Therefore

$$\underline{p} = \frac{Pt}{\text{Area}} = \frac{Pt}{4\pi r^2}$$

which is measured in watts per square meter, which can be abbreviated as watts/meter^2. In our example, the power density is

$$\underline{p} = \frac{100 \text{ watts}}{12{,}566{,}360 \text{ m}^2} =$$

$$.000007958 \text{ watts/meter}^2$$

which is equivalent to 7.958 microwatts per square meter. You can clearly see that, by the time the signal is spread out over even a fairly small sphere like this one, it represents a small power density indeed.

Antenna Gain

Since an isotropic antenna is already 100% efficient, radiating all the power it gets from the transmitter, we cannot improve on the total power radiated simply by changing to a different antenna. In other words, we cannot increase the power density in the above example uniformly over the entire sphere just by changing the antenna. However, we can use a *directional* antenna which concentrates the power in some preferred direction, always at the expense of the power going in some other direction. In other words, a directional antenna diverts some of the power which would normally go off in some undesired direction, and concentrates it in some other direction. From the standpoint of a receiver standing in the right direction, which is now getting more signal than it would have with an isotropic antenna, this looks like the antenna has *gain over an isotropic antenna.*

For example, a half-wave dipole has little or no radiation off its ends. Instead, it takes the power which would normally be radiated off the ends, and sends it out broadside to the dipole. Doing some high-powered calculations tells us that a half-wave dipole (assuming that it does not lose power in heat) sends out 1.64 as much power in a direction broadside to the dipole as an isotropic radiator would have. A power gain of 1.64 translates into a gain of 2.14 dB, and so we would say that a half-wave dipole has a gain of 2.14 dB over an isotropic antenna.

Obviously, then, an antenna with high gain has to be very directional, since all this apparent gain is achieved merely by aiming the radiated power in some preferred direction. (The opposite of this statement is not

necessarily true, though, since an antenna might be directional and lossy. Such an inefficient antenna might then lose a large portion of the power before it is radiated, resulting in a very directional but weak signal.)

To continue with our example, suppose our 100 watt signal were radiated with an antenna having a gain of 3 dB over a dipole. This basically means that there is some direction in which the particular antenna transmits 3 dB more power than a dipole would. Since antenna gain is usually measured by the manufacturer in the most favorable direction, called the *major lobe*, such an antenna would have to be aimed reasonably well to get the full benefit of this 3 dB gain over the dipole.

We might then ask – what would be the power density 1000 meters away in the direction of the major lobe? In order to do the calculation, we have to convert the gain, specified as 3 dB over a dipole, into a gain over an isotropic radiator. Since the dipole itself has a gain of 2.14 dB over the isotropic antenna, the total gain of our given antenna is 5.14 dB over the isotropic antenna. Using the standard formula for converting power gain into dB, we work it backwards to get a power gain of about 3.27; in other words, the power density in the desired direction (major lobe) of the antenna will be 3.27 times that produced by an isotropic radiator. In our example, the power density would then be

$$3.27 \times 7.958 \text{ microwatts/meter}^2 = 26.02 \text{ microwatts/meter}^2.$$

Signal Strength

The above calculation shows us what the power density a certain distance from the transmitting antenna is. However, signal strength is usually given in units such as volts per meter, and it would be useful to be able to convert from one to the other.

In ordinary circuits we can relate the voltage and power in a circuit by the relation

$$\text{Power} = E^2/R$$

Given the power and resistance, for example, we could solve for the voltage. Interestingly, free space (vacuum, but air is very similar in its propagation characteristics to a vacuum) also has something called a "characteristic wave impedance" which for all intents and purposes is like the resistance R in the above equation. Using the same equation, and using the characteristic wave impedance of free space, which is 377 Ohms, allows us to relate the power density and the field intensity (signal strength) in free space (or air, which is for all intents and purposes the same). In this case,

$$\text{Power density} = \frac{(\text{field strength})^2}{377 \text{ Ohms}}$$

Even the units of this work out nicely; since the field strength is measured in volts per meter, the right hand side of the equation is

$$\frac{(\text{volts/meter})^2}{\text{Ohms}} = \frac{\text{volts}^2/\text{meter}^2}{\text{Ohms}} =$$

$$\left(\frac{\text{volts}^2}{\text{Ohms}}\right)/\text{meter}^2 = \text{watts/meter}^2$$

which is the perfect unit for a power density.

To go from a power density to field strength, we have to juggle the equation a bit:

$$\text{Power density} \times 377 \text{ Ohms} = (\text{field strength})^2$$

$$\text{Field strength} = \sqrt{\text{power density} \times 377 \text{ Ohms}}$$

Going back to our example above, we found that the power density 1000 meters away from the transmitting gain antenna was 26.02 microwatts per meter^2. To use the above equation properly, we have to convert that back into watts/meter^2, and then we get the field strength as

$$\text{Field strength} = \sqrt{.00002602 \text{ watts/m}^2 \times 377 \text{ Ohms}}$$

$$= \sqrt{0.0098 \text{ volts/meter}}$$

$$= \sqrt{0.0990 \text{ volts/meter}}$$

This type of calculation can be useful if you ever get your hands on a calibrated field strength meter, but in most applications we do not have to calculate the field strength to arrive at our next result.

Capture Area

Let's therefore return to the power density in free space. As you remember, the power density is used to describe the amount of power which may be received over an area of one square meter located on a sphere surrounding the transmitting antenna. In the case of a gain antenna, such as the one in our previous example which had 3 dB gain over an isotropic antenna, we have to measure this power density in a direction where the transmitted power is a maximum – the major lobe. In the previous example, this power density was 26.02 microwatts/meter^2.

Suppose we now put a receiving antenna into this field. This receiving antenna will now absorb some of this power from the transmitted signal, and convert this power into a voltage (and current) along a transmission line leading to the receiver. The bigger and more effective this antenna, the more power it will capture out of the air and deliver to the receiver. Suppose that the antenna, when placed into the field at a place where the power density is 26.02 microwatts/meter^2 just happens to deliver 26.02 microwatts of power to the receiver. Then we say that it captures the power hitting one square meter of our imaginary sphere's area – in other words, we say that this antenna has a *capture area* of one square meter. Put into an equation, we can write the relation between power density $\underline{p}$, the capture area $A_{capture}$, and the power actually received and sent to the transmission line P_{rec} this way:

$$P_{rec} = \underline{p} \times A_{capture}$$

In plain words, this simply means that the power actually intercepted by the antenna is equal to the power density (in watts per square meter) times the capture area (in square meters). The greater the capture area of a receiving antenna, the greater the amount of power it picks up out of the air and sends to a receiver.

As you might suspect, there should be some connection between the capture area of an antenna and its actual physical size. For certain antennas, such as parabolic dishes of high gain (which, by the way, are also very directive) the capture area is almost equal to the area of the dish as seen by the arriving signal. In such a case it becomes quite easy to estimate the capture area of a dish and, from the area, calculate the gain.

With most other antennas, however, the capture area is larger than the actual physical area of the antenna as seen by the arriving signal. Certainly the cross-sectional area of a wire antenna as seen by the arriving signal is very small, whereas the amount of signal picked up by a wire antenna can be substantial. In such a case the capture area of such an antenna can be quite a bit larger than the actual cross-sectional area of the antenna. It's almost as if the antenna can reach out into the space around it to "capture" the signal.

As with many other antenna concepts, the idea of a capture area is purely theoretical. For instance, if it really did what it sounds like it does, namely capture *all* the power existing in a certain area of space, then a second antenna placed behind the first antenna would pick up no signal at all, and we know that is not true. Similarly, putting a reflector behind a dipole would do nothing because there would be no signal there to reflect, whereas we know that reflectors are commonly used in beam antennas. Still, the idea of a capture area is useful because it allows us to calculate other antenna parameters. Specifically, it lets us know how much rf signal a given antenna will pick up and deliver to the receiver.

Just a few paragraphs ago we mentioned that the capture area of a high gain dish is easy to estimate; for most amateur antennas this is not the case, and so we have to go backwards. Instead of estimating capture area and using it to calculate the gain, we measure the gain and use it to calculate the capture area.

The gain of an antenna is reasonably easy to measure by comparing it with that of a half-wave dipole. Once we have that, we calculate the capture area from the following equation:

$$A_{capture} = \frac{\text{Gain} \times (\text{wavelength})^2}{4\pi}$$

The wavelength in the equation is simply the wavelength of the signal which the antenna is trying to pick up.

You may wonder what this equation means. It's easy to see why the Gain term is in it – if you double the gain of an antenna, that means it picks up twice the signal. But that means that it has twice the capture area.

Now, why the $(\text{wavelength})^2$ term? Let's take an example for this explanation. Suppose you have an antenna which is 3 by 10 feet in size, and which has a gain of 3 dB at some particular frequency. If we now want to build an identical type of antenna but for a frequency half as large (twice the wavelength), we will have to make a new antenna twice as large, so our new antenna will be 6 by 20 feet. Since the area of the antenna is four times as large now, we would now expect that the capture area would also be four times as large (though the capture area is not the same as the physical area of an antenna, it makes sense to expect the capture area to go up at the same time as the physical area goes up if the type of antenna – and its gain – stay constant).

Since the capture area is only a stepping stone to calculating how much power a given receiving antenna picks up, let's combine the two previous equations. We substitute the equation for the capture area into the equation which tells the received power:

$$P_{rec} = \underline{p} \times A_{capture}$$
$$= \underline{p} \times \frac{\text{Gain} \times (\text{wavelength})^2}{4\pi}$$

Finally, knowing the received power, we can use the equation Power = E^2/R to calculate the voltage in the transmission line if we know its impedance.

Practical Example

Fig. 1 shows a typical problem. In an auxiliary link on a repeater, we have a 0.1 watt transmitter on 449 MHz, feeding a 9 dB gain beam through a coax which has 4 dB loss. At the receiving site, which is ½ mile away, a similar antenna feeds a receiver through a 52 Ohm coax having a loss of 2 dB. Under these conditions, how much signal will the receiver get? Moreover, what transmitter power do we need to get a signal of 100 microvolts at the receiver?

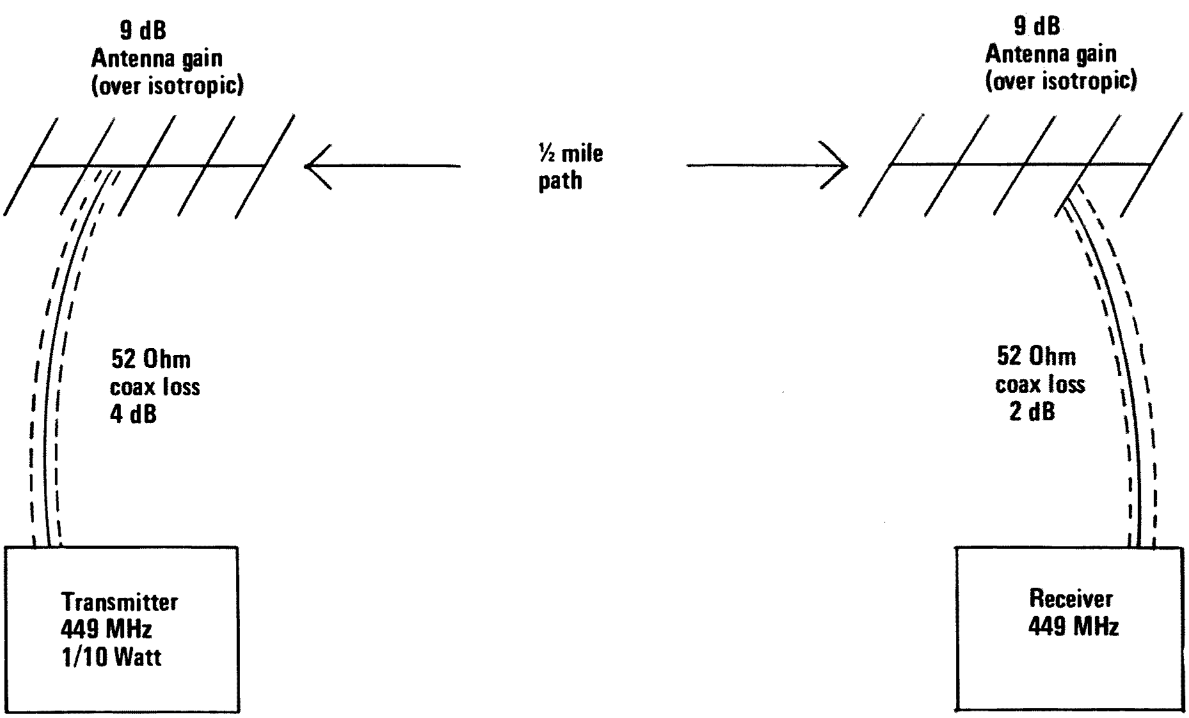

Fig. 1. Practical example of a 449 MHz repeater link.

Our calculations go like this:

1) Transmitter power is 100 milliwatts into the coax.

2) 9 dB antenna gain, less 4 dB coax loss, gives a total power gain of 5 dB in the desired direction. A 5 dB power gain is a power ratio of 3.16, so the power actually radiated toward the receiver is the same as an isotropic antenna would radiate if it was fed with

3.16×100 milliwatts = 316 milliwatts.

3) A half mile is 1609/2 meters, or 805 meters. The power density at the receive antenna is therefore

$$p = \frac{P_t}{4\pi r^2} = \frac{316 \text{ milliwatts}}{4 X 3.14159 X (805)^2}$$
$$= 0.0388 \text{ microwatts per meter}^2$$

4) 9 dB antenna gain on the receiver is actually a power ratio of 8, since each 3 dB power gain doubles the power. The wavelength at 449 MHz is 300/449 = 0.668 meter, and so the received power at the receive antenna is found from

$$P_{rec} = \frac{p \text{ X Gain X (wavelength)}^2}{}$$

$$= \frac{(0.0388 \text{ microw/m}^2) X (8) X (0.668)^2}{4 X 3.14159}$$

$$= 0.011 \text{ microwatts.}$$

5) Another 2 dB is lost in the receive coax line, so the power actually at the receiver is only

$$\frac{0.011 \text{ microwatts}}{1.59} = 0.0069 \text{ microwatts}$$

6) We use $P = E^2/R$ to calculate the actual voltage at the 52 Ohm receiver input:

$$E^2 = P X R$$
$$E = P X R$$
$$= 600 \text{ microvolts}$$

7) If we see that we only need 100 microvolts at the receiver for perfect copy, then the above signal has 6 times the voltage. Since Power = E^2/R, we see that the power is proportional to the voltage-squared; in other words, we have 6^2 or 36 times the power we need. Hence we could drop the transmitter power by a factor of 36 down to 2.77 milliwatts, and still get 100 microvolts of signal at the receiver.

This example shows the theoretical features of this approach, but it has a number of practical disadvantages. It assumes the perfect case — perfect line of sight, no absorption of the signal in the air or in any other objects, no reflections from nearby objects which might cancel out part of the signal, and perfectly good coax, fittings, antenna, and all other parts. It also assumes that the manufacturer of your antenna is telling the truth when he specifies 9 dB gain over an isotropic antenna. In any practical case, it might be a good idea to include a safety factor of 1000% — or more — to compensate for aging, wear and tear. Still, an analysis such as this does give you a rough idea of the *minimum* reasonable power that might do the job.

Path Loss

In the above example, we started with a transmitter output of 100 milliwatts and wound up with only 0.0069 microwatts at the receiver. This is a total loss of

$$10 \log \frac{100 \text{ milliwatts}}{0.0069 \text{ microwatts}}$$
$$= 10 \log (1.45 X 10^7)$$
$$= 71.6 \text{ dB}$$

Part of this signal loss was loss in the actual transmission, while part was due to the antennas and coax lines. In the above example, the antennas actually contributed an 18 dB *gain* (9 dB for each antenna), while the cable loss added up to 6 dB (4 dB at the transmitter, 2 dB at the receiver). This adds up to a total *gain* of 18 – 6 = 12 dB. In other words, we had an effective gain of 12 dB and still lost 71.6 dB in the transmission; this means that the loss in the ½-mile path was actually 71.6 + 12 = 83.6 dB. This is called the *path loss*.

The path loss is actually dependent only on the distance and the frequency. It is calculated by assuming that isotropic antennas are used at both ends and no coax cable losses exist, and then using the foregoing equations; alternatively, we can combine all of them into one big equation which gives the path loss directly in dB:

$$\text{Path loss (in dB)} = 10 \log \frac{157.91 \text{ X (dist)}^2}{(\text{wavelength})^2}$$

where both the distance between transmitter and receiver and the wavelength must be given in meters.

The path loss is useful not only in cases where we *want* to get a signal from one place to another, but also in cases where we don't. For example, suppose a two-meter repeater is located at two sites 1/5 mile (322 meters)

apart; how much interference will the transmitter cause the receiver? The path loss is a guide to how much the transmitted signal will be attenuated in the 1/5-mile path:

$$10 \log \frac{(157.91) \times (322)^2}{(2 \text{ meters})^2} = 66.1 \text{ dB}$$

In an actual case, this path loss would have to be modified by the two antenna gains and coax losses, and might easily be only on the order of 55 or 60 dB once these are taken into account.

As further references, in addition to the many amateur radio books on antennas, you may be interested in two textbooks on antennas used in schools. The "Bible" of antenna design engineers is *Antennas* by J.D. Kraus (McGraw-Hill, New York, 1950). A more readable and shorter book for technicians is *Antennas* by L. V. Blake (John Wiley & Sons, New York, 1966). An interesting article about measuring antenna gain is "Antenna Performance Measurements," by Dick Turrin W2IMU (*QST*, Nov. 1974, p. 35).

... K2OAW

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Twinlead Phased Array

The ideal answer to many a ham's antenna problems would be directive, rotatable, have some front to back ratio, and probably most important, would be inexpensive.

The phased array to be described in this article is both simple and effective. The use of commonly available materials and "electric rotation" beats the high cost of rotors and the unavailability of some antenna components. While the antenna used by me was designed for use on forty and fifteen meters, there is no reason why this general design cannot be used on any of the other bands.

Theory

The array consists of a pair of folded dipoles fed 90° out of phase to provide end-fire directivity. This phase-shift is caused by an electrical quarter wavelength of 300Ω twinlead. By using a DPDT relay to switch the phasing line, bi-directional operation can be obtained. Each folded dipole has a characteristic impedance of 300Ω. Ideally, the two elements are fed at the center with electrical half-wavelength lines of twinlead. This brings the 300Ω resistive load present to the switching relay without inducing any reactive components. Of course, if the length specified is too long for your particular installation, don't be afraid to try whatever length is needed as long as both feedlines are of equal length. If a longer length is needed, use any integral multiple of the lengths given. At the relay the two 300Ω impedances are presented in parallel, transforming the impedance to 150Ω. This is fed through a 4 to 1 balun to bring the final impedance down to 35Ω. When fed with 50Ω coax (RG-8, RG-58) it will present an excellent standing wave ratio (SWR) across the entire band. This broadness is due to the inherent wide bandwidth of the folded dipole itself, plus the use of the 4 to 1 balun, which, besides bringing down the impedance, also reduces the change in impedance as the frequency is varied.

Construction

The elements, feedlines, and phasing line are all made of 300Ω twinlead. It is best to weatherproof the relay by mounting it in a plastic refrigerator box and then mounting

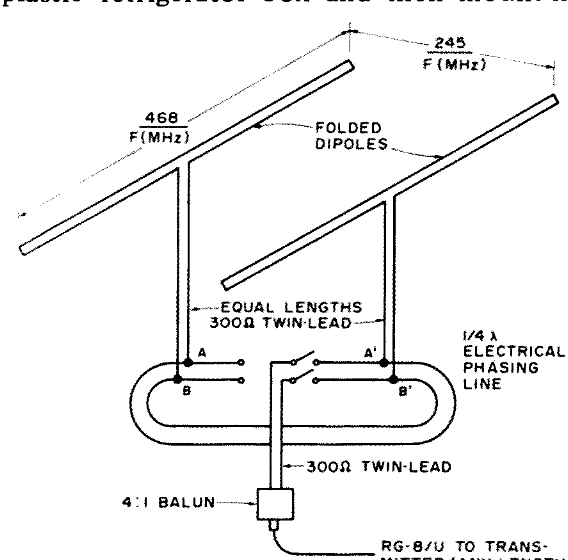

Fig. 1. Two element phased array. If SWR is unacceptable, interchange lead A with B or A' with B'. With the relay in this position directivity is to the left.

Frequency	Element		Spacing		Phasing		Elec. ½	
(kHz)	Length				Line		Wavelength	
80 Meter Band	Ft	In.	Ft	In.	Ft	In.	Ft	In.
3550	131.	9.97	69.	0.17	56.	9.87	113.	7.74
3650	128.	2.63	67.	1.48	55.	3.19	110.	6.38
3850	121.	6.70	63.	7.64	52.	4.74	104.	9.47
3950	118.	5.77	62.	0.30	51.	0.82	102.	1.64
40 Meter Band								
7100	65.	10.99	34.	6.08	28.	4.94	56.	9.87
7250	64.	6.62	33.	9.52	27.	9.88	55.	7.76
20 Meter Band								
14100	33.	2.30	17.	4.51	14.	3.68	28.	7.35
14275	32.	9.41	17.	1.95	14.	1.57		3.14
15 Meter Band								
21100	22.	2.16	11.	7.34	9.	6.72	19.	1.44
21350	21.	11.0	11	5.70	9.	5.38	18.	10.76
10 Meter Band								
18050	16.	8.21	8.	8.81	7.	2.30	14.	4.59
18600	16.	4.36	8.	6.80	7.	0.64	14.	1.28

Table I
A Simple Directive Phased Array Chart

the box on a tree or building. From the relay, zipcord can be run to a control console in the shack. It will be best to wire the relay so that in its unenergized position the directivity will be in the most often used direction. This will cut down wear and tear on the relay. If the SWR of the finished array is unacceptable, possible remedies include transposing the A and B leads (see Fig. 1) of the feedline, or changing the length of the line from the relay to the balun. The fact that changing the line length varies the SWR shows that the line is not "flat," but this is really inconsequential as the loss from high SWR in the twinlead is less than that of an equal length of perfectly matched RG-58.

The antenna can be supported by towers, buildings or four conveniently placed trees can be pressed into service.

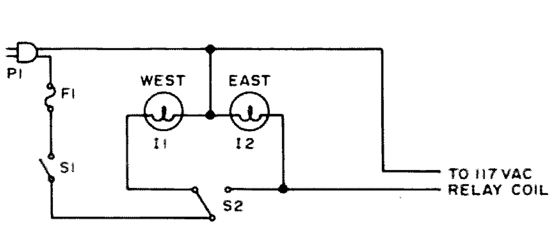

Fig. 2. This is a schematic of a control console that should be used where the most used direction is to the west. To use a lower voltage relay just put a transformer on the 117V ac output. F1 – 2 amp fuse; I1, I2 – 117V ac light; P1 – standard power plug; S1 – SPST switch (turns unit on or off); S2 – SPDT switch (selects direction).

Performance

This type of antenna cannot be expected to beat out a full size mono-band beam in terms of gain, but it can be very effective, especially on the lower bands where yagis are prohibitively large for most installations. On 40 meters Europeans could be worked nightly when using a popular 180W transceiver. This is with the antenna 37 ft in the air and broadside east and west. On the third harmonic, 15 meters, the antenna was equally effective, with some change in directivity apparent when switching the phasing line. The change in direction was not the same as that on 40 meters. The antenna was cut for 7.1 MHz and the SWR remained below 1.5 over the entire band. Similar results were found on 15 meters. On 40 the front-to-back ratio is sufficient to cut down broadcast interference on phone and stateside QRM while working CW into Europe. It varies from about 20 dB on 7.1 MHz to about 7 dB on 7.3 MHz. The gain appears to be 3 to 5 dB with respect to a dipole. By cutting the antenna for any particular frequency, performance will be optimized for that frequency.

From the performance of the 40 meter array, similar results can be expected on the other bands. All in all, this is a very effective antenna system, in both performance and cost.

. . . WB2NQT

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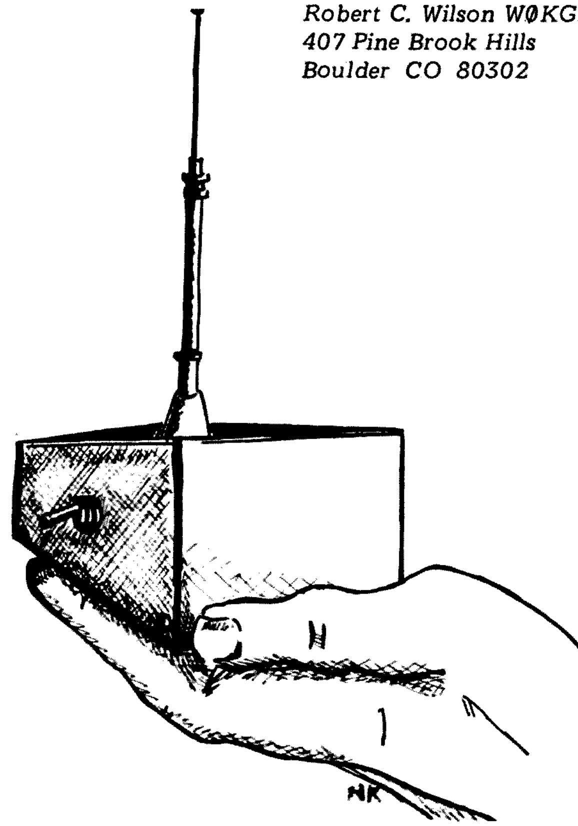

The Incredible 18" All-band Antenna

I'd like to tell you about a new type of antenna which was the subject of a paper at a recent International Communications Conference. It was designed to work on very low frequencies, but since the time of the conference, I have never heard another word about it!

It seemed to me that this was an antenna which could be adapted to other frequencies with slight modification and could fill in my need for a very small, all-band antenna to work with my 3 to 30 MHz receiver. Thus I went to work on a design and came up with a rather remarkable device.

A simplistic explanation of the antenna is that it is not an antenna in the common meaning at all. Rather it might be thought of as a capacitor coupled to all the rest of the universe. In this universe are quite a few other antennas connected to transmitters – transmitters I'd like to receive, also a few I'd rather not hear (i.e. power line noise, etc.).

The size of this capacitance must be very, very small as its elements are very far apart. Any capacitance existing must represent an extremely high impedance. Thus it is necessary to build a transformer which will convert this high impedance down to something manageable, like 52 Ohms.

Today we can manage this enterprise with real components by the use of a FET source follower, as shown in the diagram. An input capacitor is used to prevent inadvertent dc coupling to the FET gate and its subsequent destruction. At the input of the FET is also the only special component, a high quality low noise metal or carbon film resistor of about one megohm resistance.

This is required to reduce resistor noise at the input which will soon develop if carbon composition resistors are used. Of course, a choke would solve all the problems if only one could find one with a high enough impedance and no strange characteristics like resonances at undesired frequencies or low Q figures to eat up the signal.

The "antenna" portion of the unit also was a bit critical in that the capacitance to the rest of the world often needed to be adjusted to fit a particular location in the real world. For example, a nearby broadcast station or a bad fluorescent light would cause cross modulation. Thus the "antenna" used was a replacement receiver whip which could extend from about 8 inches to about 4 feet.

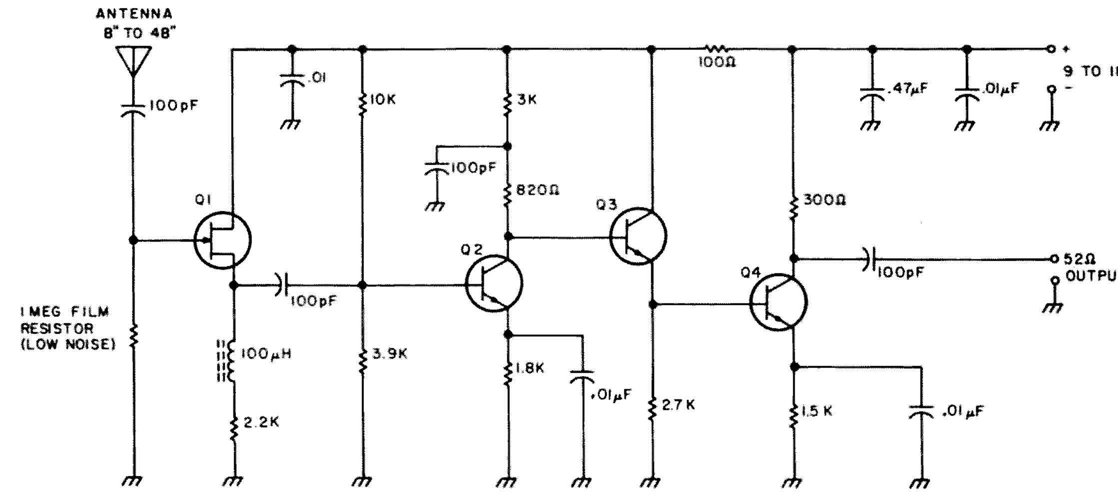

Fig. 1. Q1 = 2N3819 or equal. Q2, 3, 4 = any 200 MHz, 20V, NPN transistor, i.e., 2N918, 2N6008, etc. R = Carbon composition, except where noted, all ¼ watt.

But 18 inches seems best for most locations. Remember again this is a capacitive device, and any stray capacitance to ground from the antenna or circuitry leading to the gate of the FET causes the signal to be divided into an unwanted capacitive branch. So use a big insulator at the base of the whip and a short lead to the FET base. The units I have built are "free form" electronics with all components soldered together in space and the grounds soldered to a piece of brass .010 shim stock or printed circuit board. Looks funny but it works!

All of the circuit following the source follower is simply a 30 dB gain broad-band amplifier. The roll-off is about at 3 MHz on the low end and at about 35 MHz at the high end. By using this amplifier, the result is a lot more gain at the receiver input (and possibly some cross modulation if the antenna is extended too far). The extra gain makes the receiver think it has a quarter wave whip connected to it at any frequency from 3 to 35 MHz.

I should note that this particular broad-band amplifier has been designed to be fairly foolproof. Just don't bring the input and output close together, and do apply any-where from 9 V to 18 V. Hard core cases of local cross modulation may require a filter between the FET source follower and amplifier to remove the offending station. Or it has been suggested that a FET broad-band amplifier be used to handle the large signal levels of a local station without cross modulation. So far the capacitor-FET antenna has worked so well that neither has been necessary.

In use the capacitive antenna has been remarkable. It draws only about 6 mA from a 9V battery. I can tune to any frequency in the working range and receive good strong signals, the kind that often have my PRO 310 "S" meter needle on the peg. It doesn't seem to be frequency selective at any place within its range and once the whip has been adjusted for the location, you can tune 10 meters, WWV, all major shortwave bands, etc., with nothing but a small box sitting on top of the receiver and a twist of the dial.

Try it, you'll like it!

...WØKGI

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An 80m Phased Array

As a confirmed 80 meter type I have always resisted the urge to put up a truly superior antenna system for that band. Finally, last summer I decided to respond to the creative urge by constructing a system which would offer advantages over a simple dipole and which would also include sufficient flexibility to permit direct experimental comparison of a number of antenna configurations which are of interest. This article reviews the approach, the results and the current status of those experiments.

Approach

Consideration of space limitations (2/3 acre) and other practical constraints, led to the choice of two parallel dipoles as the basic elements of the array. Since it was desired to switch to a unidirectional pattern and also to control the angle of maximum radiation, direct feed, rather than a parasitic array, was chosen.

Reference to the radiation patterns in the handbooks shows that a uni-directional cardioid (heart-shaped) pattern can be obtained in an end-fire array of two parallel elements, with a spacing of $\lambda/4$ and fed with a 90° phase difference. The radiation pattern in this case is a reversible cardioidal pattern with maximum gain in the direction of the lagging dipole element. This cardioidal arrangement was chosen as the basic horizontal directional array with other related options available by switching.

It is of interest to provide, in addition to the reversible cardioid, a 45° lag (higher radiation angle), a 0° lag (highest radiation angle – 90°), and 180° lag (8 JK configuration – low angle, bi-directional) and, for comparison purposes, each of the two dipoles separately. This is a total of eight different pattern options!

Still in the experimental stage is an attempt to achieve the same options using quarter wave vertical radiators. Thus far, with the ground system available, the performance of the vertical system is uniformly inferior by about ten decibels.

Circuitry

The entire circuitry for the horizontal and vertical phased arrays is shown in the schematic diagram, Fig. 1. Instantaneous switching from one pattern to another is achieved by only three switches: a main selector switch S; the reversing switch X, which permits 180° phase reversal; and the 4PDT switch for changing between the horizontal and the vertical arrays.

For purposes of description, the system will be treated under the following headings: The Horizontal Dipoles; the Verticals; Impedance Matching; and the Switching Manifold.

Horizontal Dipoles

The original installation utilized two dipoles as described previously in my article "Construction of a Balanced Dipole Antenna" in *73* Magazine. The centers were 46 feet above the ground with a horizontal spacing of 61 feet. The RG-8/U feedlines, one wavelength long, were inside the masts with the balun action and lightning protection as previously described. This original arrangement gave very good operation.

However, since it was desirable to have the lowest possible angle of radiation the centers of the two dipoles were raised to 61 feet ($\lambda/4$). This was accomplished by lengthening each steel mast by the addition of a thirty foot length of three inch diameter aluminum irrigation pipe at the bottom end of the mast. The steel mast is inside this pipe and the overlapping portion is bolted securely by use of 1/4 inch plated bolts through the pipe and mast in perpendicular pairs. (No. 8 self-tapping screws in the steel mast served to space the mast within the pipe radially before the bolts were put in place.)

No data could be taken for comparison of these two heights but it is assumed that the 61 foot height yields a somewhat lower angle of radiation for each pattern option.

Verticals

The sixty-one foot masts are fed as top-loaded verticals. The horizontal dipoles are connected to the top of each mast and the two halves of each dipole are connected together by shorting the opposite end of the 1λ feedline.

Referring to the diagram, all of these connections are switched by means of the 4 PDT switch. This permits the selection of all of the vertical phasing options by the selector switch S just as for the horizontal system.

The resonating and impedance matching of the verticals is accomplished by the capacitors C and the inductors L. A noise bridge was used to insure adjustment to 52Ω resistive input at 3.955 MHz.

The 220 pF fixed mylar capacitor connected across the feedlines of the verticals, during use of the horizontals, serve to tune out residual reactances for optimum swr to the horizontals.

When full lightning protection is desired the bottoms of the masts are connected directly to ground by means of copper jumper cables. With this connection the horizontal array can be used with dc paths to ground from both sides of each dipole, giving full protection against build-up of static charge.

Impedance Matching

The feedline input impedances are 52Ω resistive at the resonant frequency (3.955 MHz). It is necessary to switch-in phase lag by inserting a length of 52Ω line in either of these feed lines, as desired, and to feed equal currents to both dipoles while maintaining a 52Ω match at the transmitter output.

This is accomplished by use of two quarter wave transformer sections of RG-11/U (75Ω) coax. These serve to transform the 52Ω antenna input impedance up to 108Ω by the relation:

$$\text{Zinput} = \text{Z}^2\,\text{Line}/\text{Zoutput}$$

When these two 108Ω inputs are connected in parallel the resulting 54Ω value is well matched to the transmitter output.

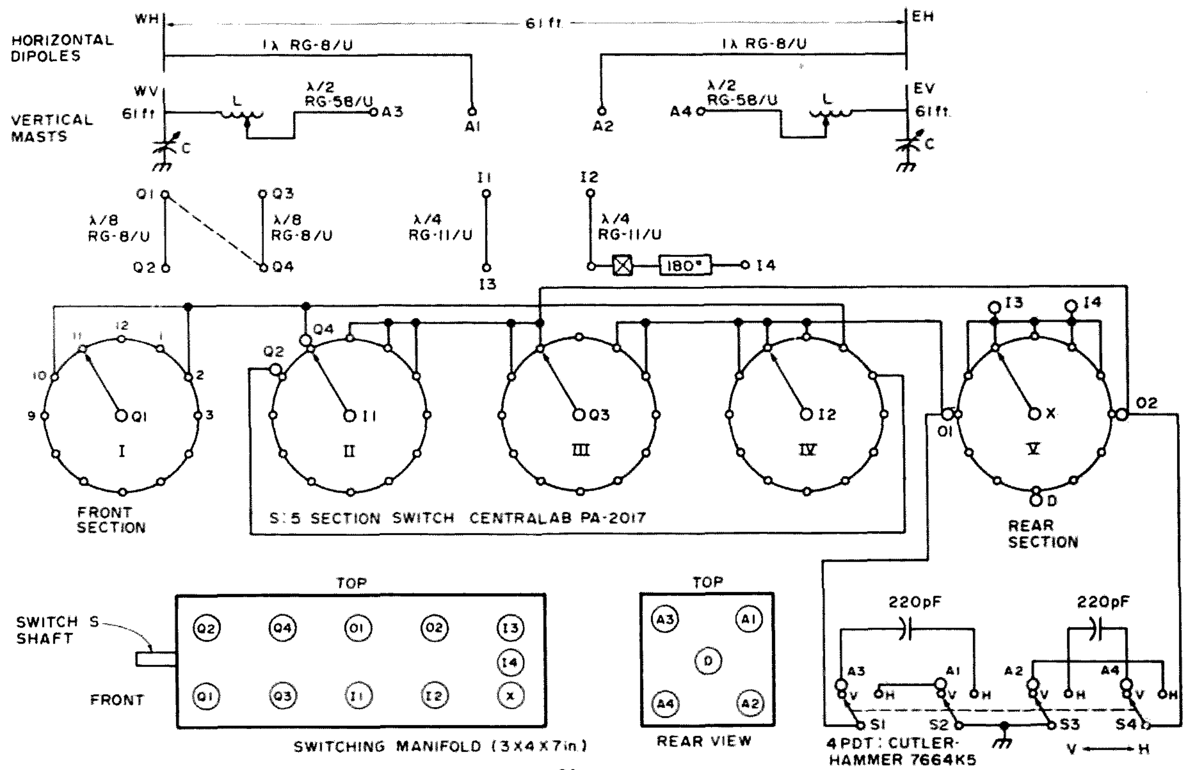
Switching Manifold

The heart of the switching manifold is the 5-section 12-position switch, S. The current rating of this switch is sufficient to handle the full power as long as the transmitter power is removed before the switch position is changed. As the diagram shows, the system can be switched from the west antenna alone, at the 9 o'clock position, through the various angles of radiation to the east antenna alone, at the 3 o'clock position.

The reversing switch permits instantaneous switching of patterns, for example, from east to west, without having to turn the selector through the intermediate positions.

Only four of the twelve switch positions are not used: 4, 5, 7 and 8 o'clock. The six o'clock position is used for a dummy load

The switches are mounted in the 3 x 4 x 7 inch aluminum chassis box with the sixteen coax sockets as shown. The box is



Notes

$\boxed{180^\circ}$: Transposed coax 6" long

$\boxed{X}$: Reverse switch 4 PDT Cutler Hammer 7664K5

O_1, O_2: 'Scope
O, o: Chassis coax
X: Transmitter output
L: Master mobile 40m coil, tapped
C: Receiving variable 200 pF

D: Dummy load
9: West antenna
10: Directive west (λ/4 wave lag)
11: Directive west (λ/8 wave lag)
12: Out of phase (8 JK)/ In phase
1: Directive east (λ/8 wave lag)
2: Directive east (λ/4 wave lag)
3: East antenna

Fig. 1. Schematic diagram – 80 meter phased array.

mounted under a projecting top of the operating desk. The four lengths of coax used for matching and delay lines are wound on a wooden reel and placed inconspicuously behind the desk.

The connectors O1 and O2 provide inputs to the vertical and horizontal plates of an oscilloscope for a Lissajous display of the inputs to the two antennas. (The integral scope in the CE 100V transmitter is used at W2OZH). Thus, the phasing and the amplitude of the rf voltages can be continuously monitored, allowing any change in either antenna to be immediately noticed.

The scope shows a circle for the cardioidal patterns, diagonal lines for in-phase or out-of-phase, and a flattened ellipse for either antenna alone. (This pattern is elliptical rather than a straight line due to the rf energy picked up by the non-energized antenna.)

Performance

The performance of the array has been all that was hoped for, both for transmission and for reception.

The swr is consistently low (under 1½:1) for all configurations. The array shows a broadband behavior typical of coupled resonant circuits. The swr remains low throughout a bandwidth of some 400 kHz – only the phasing varies.

The measured front-to-back ratio is of the order of 15 dB and the gain is about 4 dB, for both transmission and reception. The improved operation for low angles of radiation is sometimes spectacular – a net of California stations on 3952 kHz could be repeatedly heard and worked during the winter at 9:30 pm EST!

One of the most pronounced characteristics noted has been the great reduction of QRM for reception. The combination of

the high front-to-back ratio and the low angle of radiation serves to reduce the level of some signal strengths while increasing the level of others. Thus, there is often at night-time a sort of single-signal performance which is very gratifying. (It should be gratifying to the stations off the back of the pattern too!) This single-signal selectivity of the antenna system is particularly impressive when the station being worked also has a low-angle directive antenna system. In this case the directivities complement each other with spectacularly strong signals at either end.

For the type of operation prevalent at W2OZH the two cardioid patterns are used more than 90% of the time. Frequently the out-of-phase (W8JK) bi-directional configuration is used for calling CQ and the proper cardioid pattern is used for the ensuing contact. Under normal conditions there is little need for a linear amplifier, once contact has been established. The principal directivities are in the east and west directions so stations to the north or south are seldom worked. The 0° or 45° phase shifts and the single dipole patterns seldom show consistent superiority over the cardioids. It is interesting to listen to two stations on the same frequency which have about equal signal strengths, when one is to the east and the other to the west. Either signal can be selected at will by switching the cardioid patterns and the unwanted signal is barely audible in the background!

Such an array would be a great boon to stations located on the coasts as the 3 dB of power wasted out over the water could be largely utilized.

The only disappointment thus far has been the consistent weakness of signals from the vertical antennas. The separate vertical antennas are typically down about 10 dB compared with the horizontals and this inferiority carries over to the vertical array, regardless of direction or distance. The poor performance of the verticals is attributed to ground losses, with attendant high radiation angles, in spite of the fact that a parallel grid of about 3500 feet of ground wire is used. Perhaps this explains why so many writers describe their eighty meter vertical constructional features at great length with hardly any space devoted to results. Maybe the results were unprintable!

Weather and motivation permitting, I plan to experiment further with improved radial grounding and I hope to get some meaningful quantitative comparisons. Meanwhile I will be skeptical when I hear of a "superior" 80 meter vertical with only a modest ground system.

Conclusions

A two-element horizontal phased array for 80 meters has been constructed with a total of eight pattern options available by direct switching. Operating results have confirmed the expected gains and front-to-back ratios. The performance of the unidirectional cardioidal patterns has been particularly effective, especially when the station being worked also has a directive antenna system.

Preliminary results using a vertical array with similar pattern options have not been encouraging, apparently due to high ground losses. Further experimentation on this system is planned.

. . . W2OZH

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An Honest 6 db on 450 MHz

... the stacked collinear

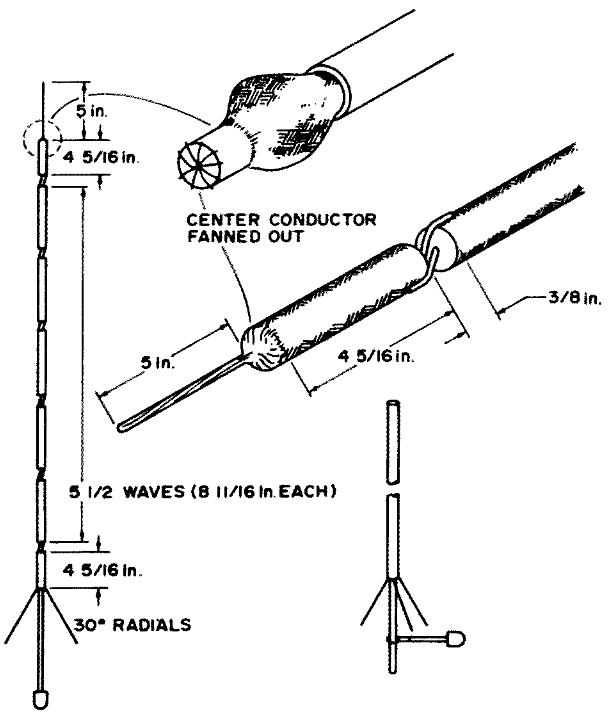
This antenna can be called a stacked collinear, but whatever it is called, it does a beautiful job in the 450 MHz band. Inspired by a similar design in another magazine for 2 meters, and in dire need of a good antenna for 450, I recalculated the dimensions and built it. There are 3 of us on 449.1 in the Dallas area; myself (W5GDQ), WA5QFO and W5GQE.

I had been trying my 6 Watt RCA Carfone base station on my 2 meter antennas, which work pretty well, but I am tired of wearing my rotator out on VHF and wanted a little more gain. I took this antenna, hung it from the light bulb in the garage and noted considerable gain over the 43 foot 4 element 2 meter beam with W5GQE some 20 miles away. (His antenna was about 50 ft. high.) With this antenna about 51 ft. above the ground, I am now hearing a Ft. Worth 3 Watt transmitter about 26 μA at this limiter.

Construction

Start by cutting 5 pieces of RG-8 10 inches long. These will be the 1/2 wave sections. Strip the braid back until the braid is 8-11/16 inches long. The braid should be centered in each section leaving about 3/8" gap between the sections as in the drawing. cut another section of RG-8 about one foot long; strip the rubber insulation back about 6". This will be the bottom section. Strip some of the braid back and overlap center-conductor to braid as before placing this section below the already assembled 5 sections. Solder this piece on. On this bottom section, from the top edge of the braid, measure down 4-5/16 inches. Mark this spot. Tin it with solder and mark it again. This is where the 4 radials will leave the braid for their drooping 30 degree 5 inch run. Needless to say, start your radials with about 6½" lengths then bend them, measure 5" and cut them off. Then solder securely, binding them with copper wire first. I found it much easier to put one radial on, bind it, solder it, cut off the rest of the unused copper wire for binding, then go to the next radial. For the radial material, brazing rod is ideal. It bends with no difficulty but won't accidentally bend and solders very well. Put your coax connector on the bottom of this section.

For the top section, cut a 12 inch length of RG-8. Prepare one end as before. Remove the rubber insulation. From the upper end, pull the braid back to where you can see the point 4-5/16" from the bottom edge of the braid. Mark this point. About 1/4" further



towards the top, cut the insulator and center conductor off. At the point where you made the mark 4-5/16" from the bottom edge of the braid, carefully cut the polyethylene off leaving the exposed center conductor and the still pulled back braid. Cut the center conductor off leaving about 1/16" exposed. Fan each strand out to the edge as shown in the figure. Pull the loose braid up over the cut off center conductor and pull down tight as shown. Solder the braid to the fanned out edges of the center conductor, then solder the braid making it solid up for about another 5½." Measure up from the fanned out center conductor and cut the braid off at 5 inches. This 5 inches will not compute with your formulas but for some reason works best.

This completes the construction of the antenna itself. I recommend you buy a 10 foot length of PVC rigid plastic pipe 3/4" diameter. You will find it measures about 1 inch but that's OK. Lay your newborn antenna down on the floor. Place the PVC pipe beside it with the bottom edge of the pipe at the top of the radials. Cut the pipe off about 4 inches longer than the antenna from the radials up. At the top section of the antenna where you have the top two sections soldered together, drill a small hole through the pipe. Place the antenna inside the pipe and thread a piece of nylon fishing line through the pipe, through the gap in the antenna and out the other side of the pipe. Tie securely. This will keep the antenna straight and taut in the pipe. Seal the upper end of the pipe with either the cap, plastic wood, fiberglass, epoxy, etc. I cut another 4 inch piece of pipe and put it up under the radials and epoxied that in solid.

Take the remaining PVC pipe, cut off 12 inches, and take the rest and place below the antenna overlapping 12 inches. Take PVC cement and cement the two pipes together. After they are dry, take the remaining 12 inches of pipe, and rip it lengthwise into 4 pieces. Throw 2 of them away. Take the other two and place along the 12 inch overlap in a concave fashion. Cement them onto the assembled antenna. At your local TV shop, for about $2.50 you can buy a package of 2 (you need only 1) 6" wall mounts. They may have an extra chimney mount you can buy cheaper. The only difference is the chimney mount is at a 90 degree angle instead of 180 degrees. (You can straighten it out.) In the provided hole on the bracket, your antenna will fit. Take the other end, drill holes for a "U" bolt then cut off the excess. It is now ready to mount below an existing beam and go up through it with no ill effects.

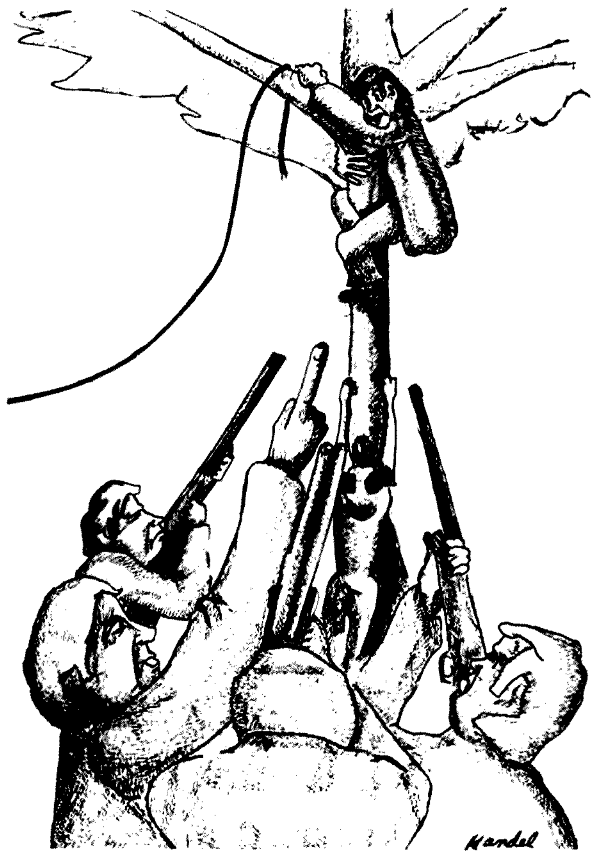
Note: More 1/2 wavelength sections can be added to this antenna as long as the number of sections is an odd number. However, going from 5 sections to 11 sections will only give you about 3 dB more gain, but a lot of construction headaches. I am using about 100 ft. of RG-213 (RG-8). This is about 5 dB loss but think what I would have if I didn't have this 6 dB antenna! . . . **W5GDQ**

INTERESTING MORSELS

What frequency did Heinrich Hertz use during his experiments of 1888-1889? HF? VHF? UHF? The answer is: Approximately 500 MHz! (60 cm)

Who took out the first patent on a tuned circuit for radio receivers or transmitters? It was Oliver Joseph Lodge, and the date was 1898. It was several years before the use of tuned circuits became common, though.

. . . **W5JJ**



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Invisible Antennas

Why ask for trouble?

If you are a little leary of putting up a really identifiable antenna like a dipole in a neighborhood that has been plagued by TVI from those who call themselves the Purple Knight, Cotton Picker, or whatever, than an invisible antenna is for you.

Well, not actually invisible, but very difficult to see from your neighbor's property line. The secret is to use very thin wire. My present 80 meter inverted vee is made from #30 magnet wire and even when you are looking for it, it's very difficult to see. The strength is not as great as with thicker wire, but this 80 meter job held up to everything but a freak Texas ice storm. Then again, a lot of the trees didn't do so well either.

The easiest configuration seems to be an inverted vee with the feedpoint at or near your shack. A long wire is also good, but difficult to install and maintain. Other variations stick the feedline out in the air. Coax is very heavy, difficult to disguise, and it's best to keep it short anyway. Do not use those big ceramic insulators. They weigh more than the rest of the antenna and are very obvious. If you must have insulators, use a small chunk of transparent plastic. I've found that fishing line is beautiful stuff. It's an insulator, is very strong, and doesn't seem to soak up rain. At the far ends of the antenna, use one of those knob insulators with the screw in the ceramic, or just wrap the fishing line around a tree branch or whatever you're using for support. If you are after a little height, heave the insulator over a tree, haul down the other side and tie it off. Lightweight antennas work very well this way. You should not use utility poles, although they make very nice supports and tend to make your antenna appear to be just another power line.

Just as important as what to put up is when to put it up. The idea of invisible antennas is to prevent you from being the target of every noisy ignition or static crash that appears on junior's cartoons, mother's soap operas, or father's football. Therefore, it makes sense not to put up your antenna when everyone is staring at you. So choose a time when people are occupied, like prime time around 8 pm. But watch out for the half hour commercial breaks. Pick a day when the weather is not good for being out of doors. (It has been proven that antennas function best when they are erected in the

worst weather.) But watch that you don't leave suspicious footprints in the mud or snow.

There are several drawbacks to invisible antennas. The wire is difficult to see when you are installing the antenna. Make sure that you have all the kinks out of the wire as this weakens it. You must keep the wire at least 8 feet high or people will run into it and think it's a spider web, or kids will try to knock it down.

Watch out for dogs. I had a rough time in a suburb of Detroit because of one. I mean, hams are noted for being a little strange, but I had a difficult time explaining to my neighbor what I was doing in a tree in his yard in the dark! A friend of mine had a much rougher time in a heavily forested rural part of Michigan. Bob had prepared quite well. He scouted the area first, and waited for a cold, dark night when everyone was occupied with their one eyed pacifier. He wore an old fur coat because it was cold and he didn't want to tear his clothes on tree branches. As Bob neared the top of the tree, a huge German shepard noticed the unusual sight and promptly made his best attempt to let the neighborhood know about it. A young boy came out to see what the dog was barking about. Bob remained motionless in the tree, hoping that he wouldn't be noticed. The boy returned to his house and Bob breathed a sigh and returned to fastening the antenna. Suddenly, the boy and his father returned and Bob froze again. He overheard the father saying, "You're right, Kenny. That *is* a bear in that tree. I'd better get my GUN." Before Bob could get down that tree, he was surrounded by the entire neighborhood, including barking dogs, kids yelling "shoot, shoot," trigger happy fathers, and lots of artillery. Bob spent a long time trying to explain, but the people just shook their heads and walked away.

Invisible antennas are not subsitutes for large arrays, but are for the ham who wants to put out a signal strong enough to get out of his state and doesn't want to attract attention to himself. I've used these antennas with peak powers up to 300 watts, but I see no reason why you couldn't run more power if you are careful. Good luck and have fun. . . .**WA8BHR/5**

Voxpoop

Here are some more reader comments and requests received recently. Wonderful magazine. Wish you would run an article on digital computers in the future – Pemberton, Evansville IN. *(I'm sure many readers would be interested in such an article; any authors for this? – Wayne.)* Cut some of the endless babble about 2m FM . . . glorified CB – WN8KYO. *(Sorry to hear 2m is that bad in West Virginia – it's nothing like CB at all here in the East – or have you ever heard 2m? – Wayne.)* I would like more state of the art solid state projects, UHF construction projects, product reports on some of the newer ham rigs such as the Ten Tec Triton and Kenwood TS-520. Great magazine, keep it up – WNØMBY. *(Anybody use a Triton out there? We'll have a 520 report before long – I think – getting one is a real bear these days – Wayne.)* Enclose a readers service card in the magazine which does not have to be cut off another page – K4ACH. *(Love to, but the printer wants about three cents each to do this, and that is a bundle. Perhaps we can find a printer to do it for less as it should cost a fraction of that – Wayne.)* Since there are more and more repeaters now in use, some readers like myself may be interested in a construction article on a frequency synthesizer for 2m – WA8AUD. *(We beat you to it in Nov. – Wayne.)* Really enjoy your solid state news – WA4RJD. I'd like to see a few articles on phase lock, TTL and op amp basics so readers like me can know more about them – Sanford, Nanuet NY. *(A reader has spoken, authors – Wayne.)* I thought the article on the ID timer was terrific. I'm half done on its construction and can't wait until it's completed – WA3VRR. Please expand SSTV coverage – Schmidt (lifer). *(Glad to – Wayne.)* When I first got into the hobby, about 12 years ago, I devoured every copy of 73. I have a complete set up to 1972, but now buy only occasionally since I feel the magazine has become specialized. I have nothing against FM or state of the art lab equipment, but I really miss those basic communications articles and simply written technical articles – WA7ZTO. *(So do I, John, and we'll have 'em back – you wait and see. Note that many readers are asking for simple theory articles. Authors, man your typewriters – Wayne.)* Solid State Column is a great idea! – Linder, Rantoul IL. Hello Wayne! Remember me from Brooklyn, Mensa, etc? Perhaps not, but now I'm back in hamming. I'll prod your memory sometime – WA1TYH. *(No, I don't remember – Wayne.)* I always buy two copies of 73 and then keep one handy to give away to a needy op who may not be working or to a prospective op who has never read 73 before. Let's have more travel articles in the States and foreign – like Jordan – K6OPG. IRS strikes: A friend, a rancher, was advised he owed $2000 and was given ten days to pay. He called them and told them he had paid and had cancelled check.. They said they didn't make errors and gave him two days to pay – K7IOO. *(Figures – Wayne.)* I dropped QST because it turned into a 150 page gossip column – WØOZG. Just keep up the good job – your magazine is great – WB6PGN. I'm always interested in articles on theory – W1MKF. How about a SWL column? Also like to see some articles on available obsolete surplus gear – and more 2m FM – WB4JUN. *(Cripes! An SWL column? Good grief! – Wayne.)* More SSTV and ATV – VE3FAH. How about less FM which is nice, but not for Novices – WN3WOM. I think complete circuits of receivers and transmitters would be helpful – Zabriskie, Weston MA. Schematic of the Month deeply appreciated, wonderful idea, please continue. How about more articles from J. K. Bach WB2PAP? Like his free and easy style of writing. "Diagrams" should be most helpful for beginners and old timers alike – VE1AMF. *(OK, more Schematics of the Month coming up. I ran out of pages last month and had to leave it out. We've a couple more good Bach articles in the works and we'll try to get him back to his typewriter for more – he is superb. Maybe we can get Bob Manning to turn out some more too? . . . Wayne)* Diagrams is the best article in the book. We need more articles like this. Anything to help us become better amateurs such as how to put out a clean signal – WB4SNK.

Voxpoop

While we are to some extent a prisoner of the authors of the articles – if they don't write them we can't print them – still we do like to know your reaction to what we do publish so we can keep trying to bring you what you enjoy the most. In the interests of science then, please let us know which articles you enjoyed the most and which you disliked most. The author of the article with the most votes will get a check for $50 extra to encourage him to get busy and write more.

WOW!

UGH!!

VOXPOOP, 73, Peterborough NH 03458

VOXPOOP WINNER

Stark vs. Dunteman

Obviously there has been some sort of conspiracy under foot to produce an exact tie in the vote for our December-January Voxpoop winner. As this is being written, the results of the race for U.S. Senator from New Hampshire are being pondered in Washington, because the contest was virtually a dead heat. This is no reason, however, for our readers to have taken it upon themselves to produce *another* deadlock.

That they did, though, as after sorting through the ballots we found that we had a tie between Peter Stark K2OAW ("Making Nicads Behave", Dec.) and Jeff Duntemann WB9MQY ("How to Get Zillions of Parts for Nothing", Dec.). Each of these gentlemen thus receives half of our $50 award for March, as well as hundreds of hearty thanks from our readers.

Don't forget to put your Voxpoop vote in the mail today – it helps us to keep producing the kind of magazine *you* want and it helps your favorite author pay the bills. The address is 73, Voxpoop Winner, Peterborough NH 03458 – and by the way, all tie contests in New Hampshire are not sent to Washington for review.

Norman C. Milne WB6PDN
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Stockton CA 95207

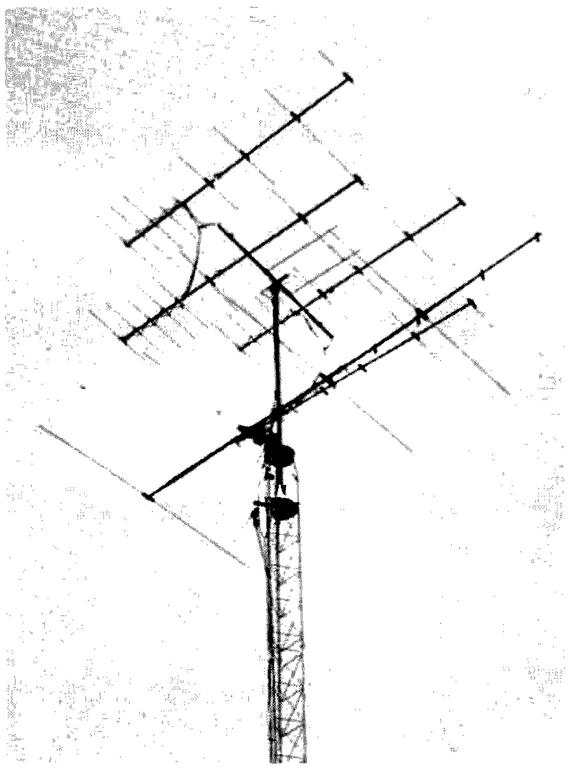
Another Look at the Swan Beam Antenna

A 73 Magazine article on evaluation of the Swan beam antenna some time ago was not comprehensive of the work that has been done in evaluating Oliver Swan's work. His multiple driven element system is one of the greatest advances in beam antenna design since the work of Dr. Yagi.[1] Swan's interest started with ham radio and branched into the TV antenna area about 25 years ago. His well-worn copy of Jasik's *Antenna Handbook* is an indication of his study into every conceivable type of antenna, and the finalized product is the result of many thousands of hours of range testing and changing.

Because of my interest in the 2 meter DX area he requested that I test his 9-element antenna on a 10 ft boom. With installation of a Rohn tilt-over tower in early 1968, it was possible to make easy installation and changes. A 9-element Swan was installed on a 10 ft stub above the rotor and because of the wide acceptance in Europe of the J-Slot, a commercial version, 8 over 8, was used as a yardstick. This particular antenna had been used for DX skeds into the Los Angeles area on both CW and SSB with 40W output.

The manufacturer's specs quote a gain figure of 14.8 dB measured on a test range. They do not give the reference antenna for this but state elsewhere in their literature that the gain figures for the 4 over 4 model are over a dipole in free space. This antenna was used as a reference because of its known quality and approximate gain figure, and is in no way to be misconstrued as a criticism of this particular design or manufacturer. A transco relay was mounted on the stub between the two antennas, which were in excess of 6 ft apart, so that either could be used for transmit or receive. Station equipment at this time consisted of a 32S1 Collins exciter, 75S1 receiver and 62S1 transverter, with a 2N4416 preamp in the receive section.

Using a weak signal source with the system in receive it appeared that the Swan was between 3 to 5 dB better on receive than the J-Slot. At this point I felt there was something wrong in the system and the tower was cranked over. A thorough inspec-



The original quad array of nines. A four element six meter beam also carries a vertically polarized Swan nine on the front portion of the boom since we have both senses out here. There is a homebrew 7 over 7 J-Slot on the cross-arm also. Low ban inverted vees have apex at rotor base for liaison on 40 and 80 during meteor showers and DX skeds.

tion was made on the J-Slot and a new balun constructed for it. There was still no change; testing continued for the next week. Del Crowell, then K6RIL, who later evaluated the Swan 6 meter version, helped by listening on his end over a 60 mile path. He confirmed a minimum of 3 dB on receive at his end. Pat Peterson WA6UAP, listening at the same time, did likewise. Del later tested the 6 meter beam and with Bill Orr W6SAI, published similar findings.[2] Pat got into the act with a weekend mountain top station, and with a large group of northern California VHF enthusiasts listening, came up with nearly twice the gain of a commercial beam of the same boom length.

Still having reservations, I sent a 9-element 10 ft boom model to Ron Hensley WB6RNH, at a research and development center near San Francisco at which there was an antenna range for government work. They made a polar plot for each 1 MHz of the 2 meter band and came up with a gain figure over a reference dipole of 15.5 dB. This figure was essentially flat over the entire band with a drop to just below 14 dB at 148 MHz. Front to back ran as high as 24 dB; there were virtually no side lobes. VHF-UHF people are extremely conservative in gain ratings on antennas and I was particularly critical of Ron's plot. He discussed it further with his antenna engineers and their feelings were that if their range was good enough for the military it should be good enough for the hams.

Oliver then made up a quad array of four of the nines for me and I continued skeds into Los Angeles and San Diego. Lanny Holt K6HAA, was very frustrated as he could hear me nearly all the time, but due to noise at my end, I managed only one CW contact. I further discussed the situation with Mike Staal K6MYC, who was quite sophisticated on 2 meter moonbounce with an array of 16 reworked collinears. He did extensive testing of the 9-element Swan, and with a quad array of 4 similar to mine, was able to hear moonbounce signals from KØMQS. Mike and Ken Holladay K6HCP, worked together on a moonbounce array using 8 of the 9-element Swans. They found this setup to be 3 to 4 dB below Mike's big array. Ken has published his findings in detail (any work on a

large array for moonbounce is extensive) and he also covers his moonbounce contacts.[3]

It had been my opinion that here was a compact antenna that would lend itself to the gain needed for good DX or moonbounce without scaring the natives by its size. Ken's article moves this into the area of practicality. Most of us would have too many problems with an array the size of Mike's without even considering the neighbor problem. With this potential of compactness I felt obligated to make an effort to have the information available to as many as could be reached by an article. This was sent to Ed Tilton for publishing in *QST*. The article did appear but only after further testing of a beam that was shipped to support the claims that were made. Our correspondence alone would make a small book.[4]

At this point I must separate fact from opinion. Most of the people I have mentioned are extremely knowledgeable in the VHF-UHF area and I am sure they will bear me out. It is possible to build good high-gain beam antennas and get them to work well. It is also possible to build them and get them to work not so well. This holds equally true with purchased beams. On the other hand there are a considerable number of both kinds around that are fooling their owners. This also holds true with feedline that is used. My opinion after much observation is that most VHF stations have poor line and poor antennas because the exhaustive testing needed to get the best performance is beyond the average ham's capabilities. This is particularly true with antenna construction and the repeatability of antennas, say, for a quad array. The baluns alone can cause many problems unless you have access to a sweep generator and scope to watch the results. Oliver Swan's biggest problems have been in the area of balun design. Finalization has meant changes in antenna design to fit the baluns. In fact the only criticism that I have been able to make has been in this area, and even this is no fault of his. Most of his work has been in the TV area, and its needs are vastly different from the ham area. However, he caught up very fast and has spent most of his recent time working in this area. He has readily supplied dimensions, insulator kits, and a tremendous amount of his time helping the ham fraternity in recent years, and will continue to do so in the future. Since each situation may require special information, I suggest he be contacted either directly or through me. I recommend the articles below, and especially the *VHF Antenna Handbook* by Jim Kyle K5JKX, a *73* publication still in print. It is very meaty.

Additional development must be mentioned. Swan has gone on to both an eleven and a fourteen element beam for two meters. I have tested both and currently have a pair of fourteens on two meters and a pair of 20-element beams on 432 MHz. I found the 11 an extremely fine antenna with a boom that is 148 in. long, and if I could have only one antenna, and if boom length were a factor, this would be the one I would choose. However, I do have fantastic results with the two 14-element units, and Bill Jungwirth WA6NRV, is ecstatic about his quad array of fourteens. Some extreme tests have been conducted with Bob Jensen WB6QDH, over what might be considered impossible paths. Most outstanding was a contact made from Reno using a Gonset Sidewinder putting out 7W and a 7-element Swan about 20 ft high. CW was used initially, with SSB employed after making contact. Bob was putting out about 40W to a pair of 11-element Swans up about 25 ft. While the distance is not extreme (only 150 miles), it was over the Sierras, a range of mountains between 9 and 10,000 ft and 4000 ft altitude at Reno. This type of path relies on what is known as knife edge refraction (bending over sharp peaks) and experienced operators on each end. Similar interesting operations are not beyond the average ham and the results are quite rewarding.

. . . WB6PDN

Recommended Reading

1. *VHF Antenna Handbook* – Jim Kyle – 73 Publications.
2. *"Log Periodic Yagi Antenna"* – Dell Crowell & Bill Orr – Ham Radio Magazine, July 1969.
3. *Practical 144 MHz Moounbounce Array* – Ken Holladay K6HCP.
4. *The Swan Multi-Drive Two Meter Antenna"* – Ed Tilton – QST Oct. 1969.

Gene Brizendine W4ATE
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City Dweller's Multiband Antenna

And now - an inverted Windom?

The antenna, being the most important single component of the radio station, poses an especially critical problem for the city-bound amateur, whose space may be limited.

One satisfactory solution is described. The characteristics of several simple antenna forms are reviewed briefly, the goal being to incorporate as many desirable features as possible from each, into one efficient, compact multiband system.

The Horizontal Linear Dipole

The center one-half of a half-wave dipole contributes most to the radiation process. It is more directional normal to the radiator. Increasing amounts of the radiated energy, which proceed directly upward, are wasted as the operating frequency is raised, never returning to receivers on earth. This energy may be channeled to lower, useful angles by forming the radiator into the popular inverted dipole. A more desirable omnidirectional radiation pattern then results, becoming slightly more directional off the radiator ends in some cases. This arrangement reduces the amount of ground space required and elevates the important center one-half of the radiator by the use of only one tall support. Efficient multiband operation requires open-line feeder and match box arrangements.

The Folded Dipole

Broadband characteristics and simplicity of construction are represented by the folded dipole. However, operation is limited to fundamental and third harmonic frequencies, such as 7 and 21 MHz. This antenna also may be installed as an inverted dipole to enhance low angle radiation.

The Trap Antenna

For fast band changing, the trap antenna is probably the ultimate choice. However, this convenience is accomplished at the expense of some losses in the isolation and matching networks. Also, in many designs, only a small portion of the structure is actively radiating on the higher frequency bands. The extensive guying necessary to some vertical trap antennas has been known to elevate eyebrows, both within and outside the household.

The Windom Antenna

In the true Windom the single wire feeder offers the lowest loss feed line system, because no insulation is used except air. Multiband operation is available on the even harmonically related 160, 80, 40, 20 and 10-meter bands, using a simpler tuner. The entire radiator actively contributes to its operation on every band.

Application

All of these simple antenna forms have been tested in the above order, mounted in the same position, over the past 5 years. The inverted Windom surpassed all others in

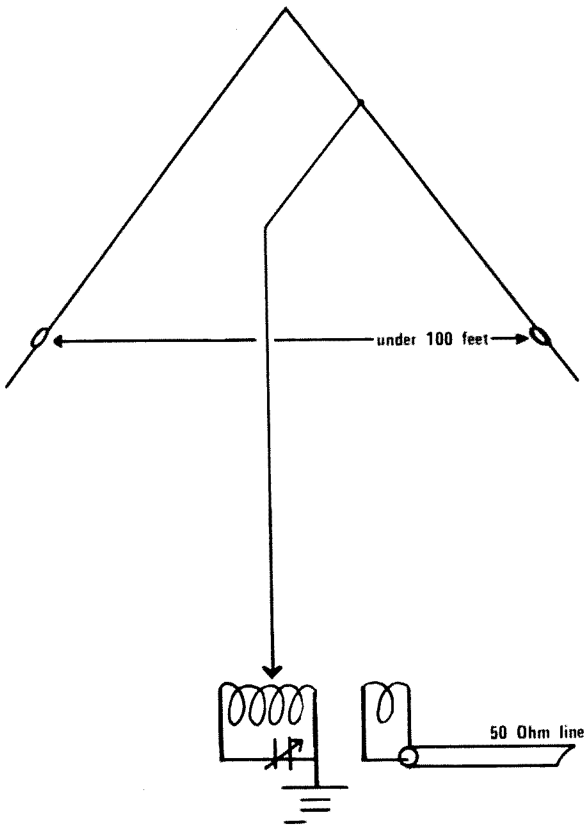

Fig. 1. Inverted Windom. The tank component ratings are the same as in the transmitter final.

signal reports, simplicity and space requirements.

The length, 140 feet, remains un-pruned for extra-class CW use on 80 through 10 meters. The single feeder is tapped at 20 feet off-center. The inverted configuration was borrowed from the inverted dipole antenna design, and for the same reasons. The radiator is supported by the family TV mast, and appears to be an unobtrusive pair of guy wires. The simple tuner in Fig. 1 was mounted at a window to avoid dielectric losses which would result if the feeder were routed inside the building. Tuneup is conventional, tapping the coil for the best transfer of energy, while maintaining resonance of the tank.

Results

Signal reports and received signal strengths favor the multiband antenna described, over the above systems, including careful comparisons with a 1,000 foot long wire pointing to Europe. Some ominous pileups have been assaulted using a single 6146 final, with rewarding results.

. . . W4ATE

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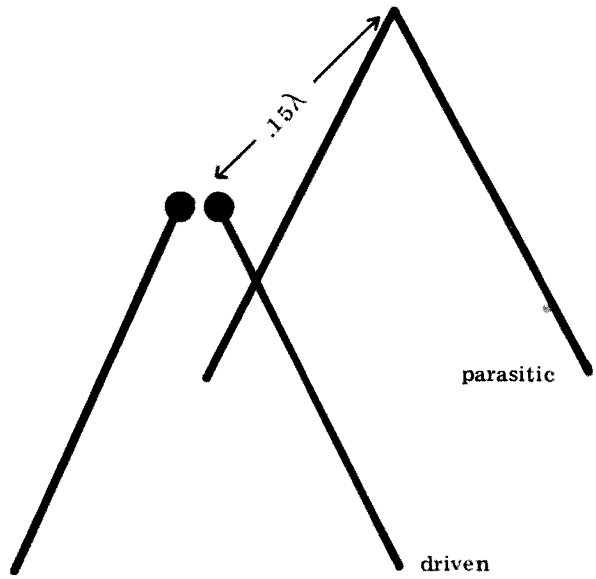
Lynnwood WA 98036

40m Inverted Vee Beam

Satisfying



Been looking for an antenna with gain and directivity for 40 meters? Read on. I will describe the antenna that I built quite cheaply.

The antenna consists of two inverted vees, one driven and the other operating as a parasitic. The spacing depends on whether you are using the parasitic as a reflector or director. I made my parasitic element a reflector/director with clip leads to change the direction of the beam.

When building the antenna, you find the length of the driven element by the formula 492/FMC = Length. For making a reflector, add 5 percent of the length. A director would be 4 percent shorter. I spaced my elements at .15 λ, or about 18 feet. One important thing to remember when putting up the antenna is to keep the apexes of the inverted vees at the same height. You can do this by using a boom, or as in my case, using two equal length poles. I live on a large piece of property, but after cruising in the city of Seattle, I think this antenna can be put up in most city lots.

My results were very satisfying. I pointed my antenna to the east and worked several east coast stations with average signal reports of S89. I then repositioned the inverted vees and pointed them at South America. I heard more DX from there than I have ever heard on 40 meters before. I hope other hams will construct this type of beam to enjoy hearing good DX on 40 meters. This type of antenna could also be constructed for 80 meters.

. . .WA7OET

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Vashon WA 98070

The Unofficial Standard Standard

Communication by radiotelephone, compared with communication by manual wireless telegraphy, possesses certain advantages and disadvantages. It is, in a sense, easier and swifter for most of us to communicate by voice, and nuances of meaning or emotional context which are impossible to convey by telegraphy can be transmitted adequately through the microphone. Conversely, when factors connected with propagation create difficult conditions, then the transmission of intelligence by radiotelephony experiences serious degradation, while at the same time it may be quite feasible to carry on, albeit more slowly, by radiotelegraphy.

At times, when static waxes severe and, alas, is combined with spectacularly infuriating interference from undesired signals, attempts to communicate by voice can end in depression and/or hysteria. It may be pertinent at this point to mention that a misunderstood message can have worse consequences than one that comes through totally unintelligible. Scientists, as is their wont, have attacked this problem with fervor, often getting their gaiters caught in the cables they are always laying about and forgetting. Sooner or later, however, they come up with an answer to anything, that being their job. Indeed, they frequently come up with several answers, as they did in this case.

If you can't make a word understood, they reason, perhaps you had better try spelling it out. And to do this you had better use words to represent the letters you are to use to spell out the original words you couldn't make understood. It is also suggested that you turn for help to special code-words (which are unpronounceable), substitute these for the words which you once had in mind (such as QRM for "interference"), and then spell these code-words by using other words to represent their letters. Well, that's science, you see. Now, then, what words to use to stand for the letters spelling out the words we wish to have understood (or the code-words representing those words)?

Standardization is clearly the key here, and to do the job properly we have been provided with several word lists, all equally standard. At hand I have three of these, which I will be happy to share with you. And a fourth which is explained below.

The first list of preferred words is from the 1928 edition of the Radio Handbook, the second is a 1968 ARRL list, and the third – reportedly even more standard than all the others put together – carries the imprimatur of the International Civil Aviation Organization. The fact that only one word is found in the same position on these three lists invited close and objective scrutiny of the selections. This task, carried

out in a coolly scientific manner, resulted in the compilation of a fourth list which I call the Unofficial Standard Standard.

In the following paragraphs of review, analysis and appraisal, quintessential brevity was the goal. Much detail was left out, including the mysterious disappearance of a consultant from Newington, whose hat was found floating in a New Hampshire bathtub. Finally, in each paragraph the italicized list-words appear in order of seniority – like the 1928 word comes first. Got it? Occasionally, in the interest of clarity, examples of typical usage are provided in the scientific manner. There are a few humorous asides.

ABLE. At least it sounds like "A." *ADAM*. Biblical, but otherwise no points. *ALFA*. Like in Romeo. At this point in time, as they used to say, let's not plug Italian cars. *ALE*. Sounds nice. One syllable and tastes good.

BOY. Doesn't sound like "B" and it fires off Women's Lib. *BAKER*. Nothing. *BRAVO*. I like you, too. Ambiguous if not confusing. Expletives are for deleting. *BEE*. Short, and sweet as honey. A real stinger. "Bee, man, just bee! Like in summertime with roses! Buzz, buzz and lay it on you! Don't you know what a bee is?"

CAST. No fun here, just a dumb old word. *CHARLIE*. Names lead you up dead ends: "Charlie who? Is he on frequency now?" *CHARLIE*. This guy has friends all over town. *CEASE*. Perfect – the plural of "C."

DOG. A zero. I thought Zero was Orphan Annie's best friend but my wife, who went to college, says I'm thinking of Sandy. Orphan Annie was the little creep with the blunk out eyes, wasn't she? Anyway, you will notice they didn't use "cat" for "C." Prejudice has no place in amateur radio. *DEED*. Neat. Sounds the same at both ends and spels the same backwards. "Whaddya mean, 'D' like in 'D' OM?" "Deed I do, deed I do!" That should do it.

EASY. Queasy, greasy, sleazy. Sneezy – which one was he? Some lazybones took the easy way out. *EDWARD*. Probably the wry wit of a sly Scot: the second Edward blew it at Bannockburn when he was run over by Robert the Bruce; the fifth was murdered by the third and the eighth resigned.*ECHO*. Substantively confusing. "Echo? Maybe it's auroral, or you're getting me long path – try swinging your beam." *EASE*. Simple and short. Like with "C" it's just the plural of the letter. Why didn't Huntoon think of this?

FOX. Sounds too much like "VOX" and may be misinterpreted as technically critical, ending the QSO. Or, if you hesitate, you have "Fox pause" and an imbroglio. *FRANK*. More invitation to confusion: "Frank? Well, frankly, your signal is sorta crummy, considering the power you're running. I've had better luck with ESP. And that's 'E' like in 'Eelgrass', old buddy." *FOXTROT*. Can you imagine those international slickers going back that far for their words? *EFFLUVIUM*. Not one you would use around the house every day, but a genuine "F" word and any good dictionary will tell you it means Citizen Band; look it up and think about getting on 220.

EFFLUVIUM: A genuine "F" word, and any good dictionary will tell you it means Citizen Band; look it up and think about getting on 220 . . .

GEORGE. A TV rassler around the turn of the century. Successfully restated the male need to be lovely. *GORGEOUS*. Let's call this second one a congenital error. *GOLF*. To be chosen by the ICAO means it's a world-word. Everybody plays golf, right? Well, almost everybody. Yuk. *GEE*. It's right because it means "right." Right? If you just keep saying "gee" sooner or later some clown will break in with "haw" and make the meaning perfectly clear.

HAVE. Possession used to be nine points of the law, but now sugar is fifty cents a pound (as this is written) and what you have is not nearly so important – unless you've got it all. *HENRY*. It would have been a good name, thanks to Laurence Olivier, but most people think of Henry the Eighth and bad vibes for the XYL's. There was a friendly Henry in the funny papers but he went bald when he was about five. *HOTEL*.

To be fair, a word that means something to everyone. The hotel with the best French cooking in the world was Cuqui de Carbajal's Safari in Zihuatanejo, Mexico – except it was a motel. Alas for the good hotels of the world – who remembers Henry (H) Busse sinking into his trumpet in the Palace Rose Room? *H* is just *H*, and what the "HE double toothpicks."

Poor planning here. *ELLEN*. Mellifluous name of Kay's mother and the last favor I will ask. Notice that the "L" sound is dominant.

MIKE. More than meets the eye to this choice, which was switched to *MARY* and quickly back to MIKE. Fascinating possibilities entertain the ruminative mind. *My lists* indicate only that the ARRL dumped Mike in favor of Mary, and that the ICAO picked up Mike who, his head turned by international recognition, no longer speaks to Mary. Was it really that simple? Watch for the exciting outcome in Jack Anderson's column. *MSG*. Accent on the "M." No, it's not "message" like on dah-dit-dah-dit dit-dah-dah. MONOSODIATEGLUTIMOUS. It's what Chinese restaurants use to make their half-cooked vegetables taste better than anybody else's, and gives everything on the menu a half-life of thirty minutes in the stomach. Now you know why Chinese restaurants are a short walk apart. Very clever.

Otto the First was king of Germany around 970, and ordered his name lettered in gold on the first VW; thereafter he was known as Otto the Mobile . . .

ITEM. Dullsville. Pardonable from a bureaucrat months this side of a pension, searching for a harmless word. Success and failure. *IDA*. Remember Ida? She was the one who sat in front of you in the ninth grade and gave the teacher fits. *INDIA*. Not bad. A word of intricate imagery – too bad it doesn't have the sound of the letter. *ISLE*. If you live on a small island, as we do, and the taxes are too high, you can call it an isle. But it does carry through the sound of the letter. Monosyllabically.

JIG. If you dance one with anybody but your wife it's up. The implications are frivolous and inappropriate. *JOHN*. I wouldn't touch this with a forty meter pole. *JULIETT*. There are five male names in the ICAO list and this single entry from the distaff side won't appease Gloria Steinem. And why two T's? *JAY*. It's the sound of the letter and it doesn't sound like anything else. To anyone outside of New York you can usefully amplify this to "jaywalk" but in Fun City the term is meaningless.

KING. Obsolete as of 1776. *KING*. Monarchists do persevere, don't they? *KILO*. 2.2 pounds – about five bucks in our money for a foreign word when many of our own are unemployed. *KAY*. A gift of love – the name of a girl I knew a hundred years ago and it's still one of the nicest words I know. Ah, youth.

LOVE. A lovely word but out of place here for its fugitive charm will not endure the abrasion of currency. Heigh ho, put it on hold with regrets. *LEWIS*. Just another solid, middle-of-the-road male label. If they really wanted an "L" name why not Llewellyn? *LIMA*. The capital of Peru, which is in Ohio.

NAN. Sounds like baby talk, depressingly suggestive of nannies and nappies. Sober thought prevailed eventually and a change was made to *NANCY*. *NOVEMBER*. A fresh start here which stumbled over the desk calendar. Three lengthy syllables rooted in three vowels, and the "n" sound is inferior to that of June – a much nicer month. *ENTER*. The hard "t" effectively terminates the accented "n" sound and the hospitable connotation is added value.

OBOE. Not a word of wide appeal. Detailed information about this instrument is not generally available to the public, and may in fact be termed arcane. Only one tenth of the world population play the oboe, and they all live in Boston. *OTTO*. Another curious choice. Otto the First was king of Germany around 970 and ordered his name be lettered in gold on the first Volkswagen; thereafter he was known as Otto the Mobile. By the way, "VW" really stands for "VorWärts!" An Afrika Korps joke. *OSCAR*. After you write it you can see an "o" is

involved. Big deal. "Auscar" sounds almost the same. (That's a VW fast going backwards, according to my German humorist.) *OKAY*. If you disqualify profanity, this is probably the word that gets the prize for international success. A natural.

PUP. Unless you are addressing a small dog this is not a word, it's just a funny noise. Lots of English words have two "p's" in the middle, and if you have to repeat "pup pup" in an effort to get the word across the reply will likely include laughter and/or complaints about your VOX. *PETER*. Given conditions bad enough to require phonetic spelling of words your contact may reasonably infer you're talking to Peter. Names are to be avoided – except for Kay and Ellen which will excite interest and close attention. *PAPA*. Fair's fair; there was no mama so there will be no papa. *PIE*. Which stands for "pi" without which there would be no radio. Granted it doesn't sound the letter like the word we can't use, but what other one can be spelled with numbers?

QUACK. I didn't believe this. More about it in a moment. *QUEEN*. The Bicentennial is coming up next year and if we cool this royalty thing in the name of the Republic we may be able to extend the ban later to Festival Princesses. *QUEBEC*. This would be nice if they pronounced it "kewbeck" but there's another problem; the Separatists may achieve partition and change it to Nouvelle Paris. *QUEUE*. The pure sound of the letter, and the suggestion of sequence is fitting. When conditions get rough what do the British do? No, they don't make another pot of tea, they queue up and behave with civility. You don't have to spell it, you know.

ROT. Another gem from the Handbook list, and a third will be along later, but now let's go back to the preceding one. "I said I'm running *low power* here, OM. Quack, Rot, Pup! Quack, Rot, Pup!" *ROBERT*. Once again, no names, please. *ROMEO*. Not even the cute ones. *ARE*. It seems that *word* is the name of the game, so this is the sound of the letter and it's a word, but not rot.

SAIL. Has as much of the sound of the letter as "ceramic" or "cent" but I like another one better. *SUSAN*. Never knew a girl named Susan so I won't make another exception here. *SIERRA*. A painful reminder of the W6's I hear working all the DX they filter out with sierras and soak up with smog. Do they really tune the mountains? On the worst days I can still hear those guys talking to the Middle East, and I don't mean Pennsylvania. *SOB*. Often this will win compassion and a little extra patience. Spelling it in the old fashioned way, S.O.B., no phonetics, will get special attention. Your contact will instantly try a little harder. When conditions improve, perhaps as a result of his renewed efforts, you can explain that the letters stand for Son of Beowulf, the Superman series on the British telly. Don't forget to explain.

TARE. A weighted choice. It only tells you how heavy a container is and cannot be converted into "S" units. Doesn't even sound like the letter. *THOMAS*. Okay, Thomas, go look for Frank, George, Henry, John and the rest of the gang. *TANGO*. Another mad entry from the foxtrot people. Besides, I saw the movie and this isn't that kind of magazine. *TEA*. Phonetically a sound substitute for the ones just bagged.. Never mind, the end is near.

UNIT. The Puprotquack people had to be right once out of twenty six tries. *UNION*. Here we have "unit" and "onion" combined just to make a different word. A cheap trick. *UNIFORM*. Too long and sounds like "unicorn" which is a protected species. *UNIT*.

VICE. Gamy implications, otherwise ludicrous. "Ready for your message, old buddy. QRV. Quack, Rot, Vice!" *VICTOR*. Another name, and offensively presumptive. *VICTOR*. Or, everybody loves a winner? *VEE*. Satisfies both the shortness rule and the ban on unnecessary length. Helpfully apt for this community of antenna-oriented souls. Clarification option for extraordinary circumstances is the addition of "inverted" or "beam" – but not both.

Do they really tune the mountains? On the worst days I can still hear those guys talking to the Middle East, and I don't mean Pennsylvania . . .

WATCH. Many Anglo-Saxon words fail to trip lightly across the auditory nerves. Squat, mash, drag. The hairy ancestor who first picked up a bone to use as a weapon probably growled, "Watch me fix this clock!" A rude-sounding word and one often used as a signal by applause-starved children poised proudly on the brink of disaster. "Watch, daddy, watch me slide down the bannister and land on the table!" And watch the bowl of gravy land in daddy's lap. Research soon proved the word could be replaced by *WILLIAM.* Then more intense research, about which we may speculate, resulted in the selection of *WHISKEY.* Unfortunately, unless my information is incorrect, "dry" counties persist in some of our states and of course this word would be meaningless there. No matter, "double-you" is perfectly adequate, just the sound of the letter, *W.*

ZEBRA: Breakfast of Champions on the Serengeti Plains . . .

X-RAY. For once all three agree. *X-RAY* and *X-RAY.* But it's a perfect opportunity to make points, so let's use *XYL.*

YOKE. Who can afford to feed oxen? That leaves the epicenter of an egg, or a humorous anecdote from Oslo. *YOUNG.* Years ago this would have appealed to me. *YANKEE.* Let's not open up old wounds. Since we've already used "XYL" and thereby disarmed the domestic militia, how about *"YL?"* Something to think about.

ZED. Licensed only in the United Kingdom and the Dominions. *ZEBRA.* A horse of two other colors, and on the Serengeti Plains the Breakfast of Champions. Depressing connotations, unless you're on the side of the lions. *ZULU.* The flower of the Bantu nation. Chaka, meet Geronimo. *Sick transit gloria mundi. ZEKE.* A succinct word for the end of the alphabet. "Zeke! Like old Zeke makes it and young Zeke wheels it down from the mountains on weekends! Zeke! The ballerina of the Japanese Air Force, the Zero with the long, round-tip wings! No, the Hamp had the short wings. Zeke, like your sister's name. Okay, same to you, fella."

. . . W7IDF

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The Mystery of Antenna Radiation

This is a subject that has been discussed, argued and has stimulated more interest than any other phase of ham radio.

The current theory of radiation depends on the electromagnetic wave theory. Briefly, it states that when an alternating current of a specific frequency is placed on an antenna of a predetermined length, calculated by the formulas very familiar to all amateurs, an electrostatic field and a magnetic field are formed, one being geometrically at right angles to the other. Both of these fields are components of the thing we call the electromagnetic wave, or more commonly, the radio wave.

These radio waves display certain characteristics, such as the speed at which they travel being equal to the speed of light; critical angles – the angle at which they approach; the direction – horizontal or vertical – in which they peel off the antenna.

All of these things have been studied, tested, tried and proven to some degree. Predictions can be made and results that have been achieved by this popular concept of wave formation have been for the most part quite satisfactory.

The only thing is, I don't believe a word of it! Many years ago, the Earth was considered to be the center of the solar system, or even further, the center of the universe. It certainly appeared to be, for it was obvious that all things in the heavens revolved about it. Mathematical formulae, predictions of eclipses, tides, moon quarters, etc., were all done with remarkable accuracy. Then Galileo looked through his telescope and realized that the sun is the center of our solar system, and we are revolving around it! A whole new system had to be devised, and of course, it was.

So it is with the electromagnetic wave. I will attempt to show you why.

If you were to hold a pebble above a still pond and let the small stone drop, a series of small concentric waves would spread out from the point of impact in all directions; as the wave distance from the point of impact increases, the size of the wave decreases. The energy of the falling stone has been transformed into a wave upon the water.

The important thing here is that the transformation of energy from the falling stone to the wave required a medium for this to happen. The medium in this case is the water, for without the water, there would be no wave of energy to move upon.

Another example is the energy of my vibrating vocal cords pushing against the air, setting up an air wave that would vibrate your ear drum, allowing you to hear my voice. Take away the medium (air) and I would be voiceless, for there would be no means of transporting the energy from my throat to your ear.

Back in the days when the electromagnetic wave theory came into its own, a small problem arose. If light (an electromagnetic wave, in theory) were to reach the earth from the sun sitting in outer space,

how would it get here? If space were a vacuum, there would be no medium and hence no sun light. Obviously, there must be a medium present. Classical physics was so sure of this that the invisible medium was called the "ether". The explanation of why we can't see it or detect it was that we were like fish immersed in water: it's all around us, thus not readily apparent.

It bothered some people that the ether was there but was yet to be detected and confirmed. Two scientists decided to do something about this situation.

The Famous Michelson-Morely Experiment

Michelson conceived the brilliant idea of splitting a single ray of light into two parts and by means of optical instruments would cause one portion of the ray to hit an optical screen; the other half would be deflected by a series of mirrors. The spin of the earth would cause an ether current (like wind on your face as you run forward).

The apparatus was set so that one half of the ray went downstream in the ether; the other half deflected upstream and then downstream. The two portions of the wave were now joined to form one again. Since one fraction had to travel further than the other, and to buck upstream ether flow, it seemed logical that one fraction of the ray would be out of phase with the other. This would mean heterodyning or beating of the waves to form new waves. The logic of this thought was sound and the experiment was carried out carefully.

Unfortunately for Michelson, when the rays were rejoined, they were *in* phase. This was a very disturbing result. Fortunately, Michelson was an honest man and reported his results as he found them. He did not believe that there was no ether, but that his instruments were too crude to detect the difference in phase.

Undaunted, he tried again. This time he improved the optics and had Morely move farther away to get more distance between source and screen. This he hoped would show the rays to be out of phase.

To his dismay, along with that of the rest of the scientific world, the rays came back *in* phase. Over and over again, the experiment was carried out. Each time the optical instruments were perfected, but alas, the results were the same. To his dying day, Michelson believed in the presence of the ether, but simply could not prove its existence.

The experiment had a very disturbing effect in the scientific world. To some, it was almost easier to believe that the earth stood still rather than scrap the wave-ether theory.

A few years later, a scientific "bomb" was dropped, followed by a whole salvo of "bombs" by two giants in the world of physics.

Among those who scratched their heads over the experiment mentioned was Max Planck who took the bold view that light was not a wave, but a "packet of energy" – a quantum. The quantum of energy that referred to light became known as a "photon".

Now, this was a very different situation. If light from the sun came to the earth through empty space as a particle, no medium is necessary as in the case of a wave; a new step in the understanding of the mechanics of the universe evolved.

The other giant in the scientific world was Albert Einstein. He grasped a hitherto unknown phenomenon from the Michelson-Morely experiment. The fact that the two light beams arrived at the same spot at the same time, even though one of them had to travel twice as far, brought forth the remarkable conclusion that the speed of light is *constant*, and if that is so, then distances must shrink and time must change to accommodate light!

This is not an easy thing to swallow and in the beginning I am sure there were very few people who could digest the concept. More likely the man was stark raving mad. Imagine rulers shrinking and clocks slowing down as they move fast enough to approach the speed of light! If you were never exposed to Einstein's theories before, you are probably having a difficult time trying to follow these weird statements. One might ask, "Do you really mean that my watch would slow down and that my twelve inch ruler would shrink if I were on a rocket ship that went fast enough to approach the speed of light?" That is exactly what I mean!

Other predictions were made. If light

were a particle, then it would be affected by gravitation. Einstein predicted that a light ray would bend if it passed near a large enough mass. He then proposed that the heavens be photographed before an eclipse and the locations of various stars be charted. Then the heavens would be photographed during a solar eclipse, when day is turned to night. The stars nearest the sun should appear to shift because the rays would be bent as they passed near the sum.

On May 29, 1919, men of science from various countries of the world, even those countries that were at war with each other, gathered in the equatorial regions in Africa to confirm Einstein's predictions. The stars in the photograph taken during the eclipse did shift, to the amount of Einstein's calculations.

Still more was to come. One step led to another until the realization that energy and mass are one and the same, that is to say that mass is coalesced energy and that one can transform mass into energy and energy into mass. The most famous equation in history was brought forth by Einstein:

$$E = MC^2$$

C = Speed of light.

The dramatic proof of the validity of this equation was given on a dark night on July 14, 1945, in the Los Alamos desert in New Mexico. The United States exploded the first atomic bomb.

The world stepped into the Atomic Age.

What does all this history of quantum mechanics have to do with a radiating antenna? To answer this, we have to walk a few steps further along the path of discovery of Einstein and Planck.

Max Planck found a relationship between energy content and wavelength (λ) of a quantum that is linked with the second fundamental constant of the universe (now known as Planck's constant). He formed the basic equation of the quantum theory:

$E = hV$ where V = frequency, h = Planck's constant, and E = energy.

With this equation before him, Einstein made another prediction, that of the photoelectric effect. Certain metals contain outer electrons in their atoms, which are loosely attached to their nuclei due to the relatively great distances they are from their nuclei.

Einstein reasoned that if an electron were struck by a photon of light, it would be possible to knock it out of its orbit, provided the photon had enough energy to overcome the attractive forces binding the electron to the nucleus. Once the electron was ejected from the atom, the metal atom now became charged positively.

As you can see from the equation, the higher the frequency, the greater the energy content of the photon. Therefore, he predicted that it is not the *amount* of light striking the metal that causes the photoelectric effect, but the *frequency* of the ray involved.

If the frequency of a ray of light is increased to the point that the photo-electric effect occurs, it is this frequency or any *higher* frequency that will produce this result, even though the *amount* of light is cut down to a feeble quantity.

To illustrate why it takes a certain amount of energy to knock out the electron, even though all light hits the metal at the same speed, let us imagine that you are sitting on a small dock, dangling your feet in the water. If a small canoe came toward the dock at 5 mph, you could stick out your foot and easily stop the canoe; however, if a 100,000 ton ocean liner came gliding up to the dock at 5 mph, you had better get your leg out of the way or it would be crushed, and for that matter, the dock would be smashed and a hole dug out before the big ship came to a halt.

This effect of energy content of the quantum can be related directly with radiation of an antenna and the reflection off the ionosphere.

The QST Handbook describes the critical angle of radiation by stating that, as the frequency of an electromagnetic wave is increased, there is less bending back from the ionosphere; as the wavelength is decreased, the bending is less and less, the skip distance increases until finally the angle is too great for any bending or reflecting from the ionosphere. The wave then strikes the ionosphere at an angle that allows it to pass through and not be reflected.

The quantum theory explains this from another point of view. If the particle of energy does not have a high energy level, it strikes the lower portion of the ionosphere and bounces off like a ball against a wall. The higher the frequency, the greater the energy content of the particle, hence it goes deeper into the ionosphere layer before it is reflected. The lower frequency particle may bounce off the ionosphere at 60 miles up, whereas the higher energy particle may bounce off the 150 mile level. (As the particle passes through the ionosphere, constant impacts with electrons drain enough energy until eventually the particle smacks into an electron of equal energy level and then rebounds back to earth.)

By increasing the frequency (and energy) the radio beam finally reaches a point where the energy level is too high for the ionosphere to stop or reflect particles, and it passes on through into outer space. It is for this reason that the higher frequencies are normally useful only for distances tangent to the earth's surface.

A word or two about the ionosphere might be useful here. In the outer reaches of the earth's atmosphere, the rarefied air is subjected to radiation from the sun. The ultra violet or *higher* energy photons strike the air molecules and cause the ejection of electrons from the outer shells. The loss of an electron ionizes (or charges) the gases positively and causes free electrons to float around up there. These free electrons eventually find their way back to a positive ion and restore a neutral state to the gas.

However, as long as the radiation continues, the sea of electrons remain, since new electrons are continually being knocked out of their orbits. Any increase in solar activity such as solar storms (sun spots) causes the sea of electrons to deepen.

In quiet times, the sea depth shrinks and at night, the ionosphere normally is less thick than in daytime.

How is a Photon or Quantum Formed?

To best understand this, we must picture an atom (of any substance) to be a miniature solar system, the nucleus acting as the sun with the orbiting electrons as its planets. These electrons orbit the nucleus in definite levels or orbits. Each level has a maximum number of electrons that it can hold. For example, the first orbit will hold two electrons. Any more electrons have to go into

the next orbit up, that can hold up to a total of eight electrons. The next orbit has a definite limit of electrons it can hold, and so on.

It is in the nature of things that atoms tend to be in a state of balance, or neutral. That is, each atom tries to be electrically neutral, with the number of electrons in orbit equal to the number of protons in the nucleus. Each electron furthermore tends to stay in an orbit at its *normal* distance from the nucleus. Any movement out of this orbit creates an unstable situation. If energy, one form or another, is applied to an atom and forces an electron to move out of its normal shell or orbit level, it (the energy) is converted to a photon by the following means: the displaced electron tends to resume its normal orbital level. In bouncing back to its regular orbit, it has to give up the energy that forced it out of the orbit. The energy thus liberated is a quantum or photon. In the case of light frequencies or higher (X-ray, etc.) the electrons closest to the nucleus emit the photons. The outer electrons do not require as much energy to be knocked out of orbit and I suspect these may be responsible for the lower frequency radiations such as radio frequencies.

From this point on, the waters muddy a bit. Some of the following statements represent the latest scientific thought and some pure conjecture on my part. However, let us plunge a little deeper into the wonders of the Universe.

The wave theory of light is not an easy theory to bury, for some of the characteristics of light can be explained by particles, but others seemed to be answerable only by a picture of wave mechanics. The phenomenon of diffraction gave the wave theory its greatest support.

If a beam of light were passed through a small hole in a plate and allowed to project on a white screen, it would show up as a white spot. If the hole is reduced in size to a minute opening, the spot on the screen has a different appearance. It no longer looks like a bright spot, but rather like a conventional target, with progressive concentric dark rings, going away from the center. Placing two small holes very close to each other has the effect of heterodyning the two sets of

waves so that alternating dark and bright lines now show on the screen. This can be easily shown with waves of water meeting with each other causing alternative cancellation and addition of the joining waves.

To further complicate matters, the famous French physicist, Louis de Broglie, in 1925 threw a body blow to the quantum theory by stating that electrons (which are particles) were not hard spheres as previously thought, but also showed wave characteristics. Put to the diffraction test, lo and behold, they too showed concentric rings!

Extension of this thought led to the amazing discovery that whole atoms and even small molecules showed wave characteristics! Is anything solid?

The interference patterns (heterodyning lines) of the diffraction of light are now looked upon in a different manner. It is now thought that the photon does not travel in a straight line, but moves in a wiggling or spiral motion. That is to say, if a photon were a bullet fired from a smooth bore gun into a pipe or long tube, it would travel straight down the center of the tube. However, if the gun bore were rifled, the bullet would travel off in a spiraling motion limited by the diameter of the pipe.

I suspect the higher the frequency, the narrower the pipe is, so that the spiral motion is "tighter".

Exactly where the photon is in relation to the center of the imaginary tube at any given moment is a matter of probability.

Evidently, the photons that follow each other through the small aperture display themselves on the screen in a wave-like pattern.

"We might say then, that photons are the components of a light beam, whereas, the wave is a description of it." (Scientific American, September 1968)

What makes some antennas good radiators and others mediocre or poor?

The "magic" formula for calculating antenna length as found in the QST handbook works very well, but does not give us insight as to why an antenna radiates.

Any conductor will radiate, but how well it radiates depends on several factors.

First, it is a matter of matching impedances from transmitter to radiator to allow a maximum transfer of energy from one to the other. Unless the capacitive and inductive reactances are properly balanced, this cannot occur.

An interesting incident occurred one evening last year to prove this point. Myself and a few other fellows were in QSO with VE3DMU in Ottawa, about 190 miles from Toronto. Band conditions that night were very good, and the further contacts were bouncing the S meter needle to 5 x 20/9.

We decided to try a few experiments with each other to see what would happen. In one experiment we reduced the audio modulation lower and lower, until it barely showed on the oscilloscope. The Ottawa station could still copy the signal, but reported a drop in audio. The same result occurred the other way – then VE3DMU in Ottawa did something else. He restored the audio to 100% modulation and reduced the rf to a bare minimum on his scope. Several of us tried the same thing and the results were the same – we were able to copy each other remarkably well on such low power.

Then the Ottawa station tried something that has had us talking ever since.

He disconnected his antenna and loaded into a light bulb as a dummy load. Restoring the output to full power, he then modulated the signal. With each modulation the intensity of the light increased and decreased in brilliance.

He then asked in a joking manner, "Do you copy me now, Doc?" "Yes, I do, Gordy" was my response, and the S-meter showed 5x7! Everyone else in Toronto heard him too, and we held quite a QSO that night on a light bulb!

I will refer to this incident in a few moments, but let us carry on as to what else a conductor must have in order to radiate efficiently.

It must have "surface area" – that is "skin" surface of conductor exposed for radiation. If you remember the method of quantum or photon production, and apply it to a conductor, it is only the outermost layer of atoms that do the actual radiating.

In the case of the light bulb experiment it is interesting to note that the light bulb gave a fairly good impedance match to the transmitter, allowing a transfer of energy to

the filament of the light bulb. It is obvious that the filament of the bulb is not 132 feet long, so that the surface area of the conductor is not as large as the conventional antenna. Hence the amount of rf leaving the bulb is not as great.

Nevertheless, there was some, enough to transmit almost 200 miles. If the rf from the filament is limited, what happens to the rest of the energy poured into the filament?

The energy backed up in the filament has placed enough force on the deeper electrons (closed orbits) in the atoms of the conductor to form higher energy photons. The filament of a light bulb does have a resistance to ac so that it will glow (radiate light), but the impedance is a good match for the transmitter.

The quantums or photons thus formed are larger (higher energy content) so that a host of new and various energy photons are formed. Now we have rf, light and all frequencies in between being formed. If the filament had more surface area, more rf and less of the higher energy photons would be radiated.

This brings to mind a few new ideas in antenna design that I would like to try some day.

On the receiver end, the photons (rf) striking the antenna set up a displacement of electrons in the surface atoms, causing an electrical potential to be set up in the conductor.

The longer the antenna, the greater the "capture" area; the more quanta striking the antenna, the greater the voltage. It is as simple as that.

No doubt many will not agree with this line of thinking, and I am sure that they have strong reasons and evidence against it. However, I believe this to be basically correct.

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. . .VE3DDS

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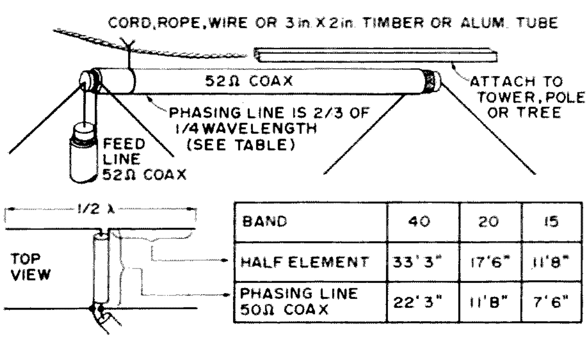
The Double Inverted Vee

If one is good, two is better

A beam costs about $200 and a quad over $100. Then there is the problem of what to hold it in the air with. A tower is the most popular device, ranging in price from perhaps $50 for a used tower up to many hundreds of dollars, depending on the type desired. The more expensive types might be crank-up, non-guyed (with tilt over action). Of course a heavy duty rotator such as a Ham M costs around $130 plus cable, freight, etc., and the cost never seems to end.



BAND	40	20	15
HALF ELEMENT	33'3"	17'6"	11'8"
PHASING LINE 50Ω COAX	22'3"	11'8"	7'6"

Fig. 1.

This antenna, which may also be built for other bands if desired, is known as a *double inverted vee,* gives good directivity and power gain in the direction chosen, but also allows signals to be heard and worked from the sides and back. Construction is relatively simple and cost can be held to a minimum depending on how it is constructed. The antenna will give a much lower angle of radiation and thus a better signal to DX areas not normally workable with simple antennas such as a dipole.

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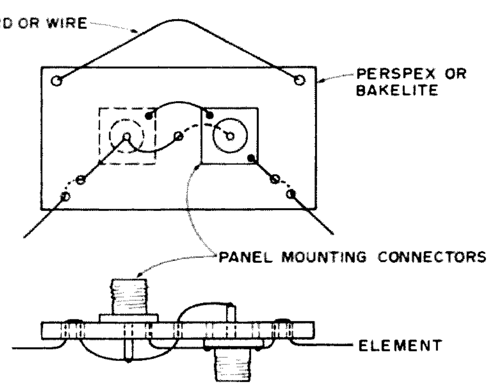


Fig. 2.

When finished the antenna looks like the outline of a tent, Fig. 1. The lower this antenna is placed to the ground the shorter the elements become due to ground effects. This can be determined by experiment with an SWR meter and cut and try, the easiest method being to allow a foot or two of the element to hang down beyond the end insulator, where it may easily be trimmed. This saves unfastening insulators each time. Fig. 2 shows how the connections may be made at the feedpoint. Alternatively the elements and co-ax may be soldered together at the appropriate points using egg insulators or similar supports. Theoretically a 1.1 balun

should be used at the feed-point, but it does not appear to make such difference.

The antenna will work well with 75 ohm co-ax but the SWR will be slightly higher, although not excessive (less than 1.5 to 1). With 52 ohm co-ax SWR should be near unity, depending somewhat on height and surrounding objects.

If no co-ax is available a twisted pair of wires will serve the same purpose as 72 ohm co-ax and should substitute quite nicely. Another possibility is 75 ohm twin lead, which will make the whole structure lighter.

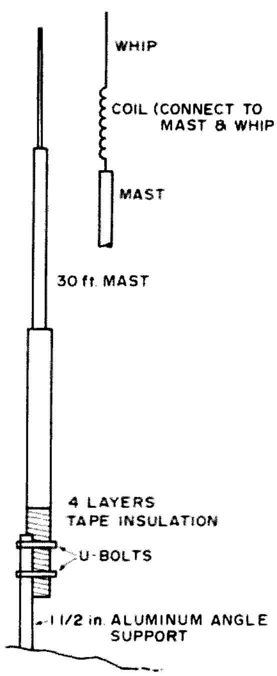
For the adventurous, more elements (up to 6 or so) can be added for higher directivity and gain. Element ends are insulated and tied off on bushes, trees or stakes in the ground. The beautiful thing about this antenna is that it is highly transportable, fitting into a box when traveling to a Field Day site and easily erected in a matter of minutes in emergency conditions. Note when more than 2 elements are used the element length, co-ax length, and spacing are exactly the same. Just add them on.

. . . VK6IZ

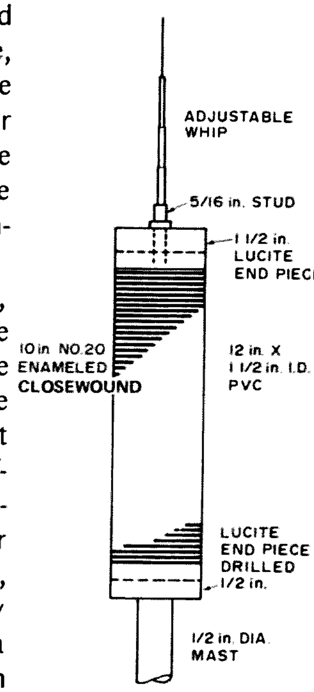
Arnold H. Rand W2NYU
124 Woodcliff Avenue
Woodcliff Lake NJ 07675

A Simple, Short 160m Antenna

Great for portable use



A thirty-foot vertical, top-loaded and using as good a ground as possible, can produce good results on 160. The antenna described here was designed for field day and portable operation, but may be made a permanent installation. It makes use of readily available materials and is inexpensive to build and easy to tune up.



Most anything can be used for a mast, as long as it is capable of supporting the loading coil, and provided that it can be made a solid low-resistance structure. The mast I used was made of telescoping 8-foot sections of aluminum tubing, using self-tapping screws at the joints for good bonding. Other possibilities might be copper water pipe, thin-wall tubing such as conduit, or even a wooden mast with a few heavy aluminum wires stapled to it to form a low-resistance conductor. I used 90 lb nylon string for guys, but if a permanent installation is to be made, wire guys and suitable insulators should be used. Four layers of scotch electrical tape are wound over the bottom of the mast as an insulator, although a better insulator might be made by using a section of old bicycle innertube slipped over the end of the mast.

The adjustable end-section above the loading coil is a broadcast-band replacement automobile whip of the telescoping type, designed to fit over the broken-off stub of the old antenna, and is available at most auto supply stores and electronics stores. This whip is used as a tuning device. Varying its length will allow you to achieve resonance at the portion of the band desired, in the same manner that the commercial mobile whips are resonated.

The loading coil form is a piece of PVC water pipe, 1½ inches i.d., with a 1 7/8 o.d., and makes a light, strong coil form of excellent Q. It is readily available at plumbing supply, hardware or home handyman centers. The coil itself consists of 10 in. of #20 closewound, the ends secured with a drop of epoxy cement after passing through a hole in the form, and lugs soldered to the ends for connections as shown in the sketch.

The end pieces, which are held in place with a screw passing through the coil form and end piece, are made of 1-inch thick lucite, 1½ inches in diameter to fit inside the coil form. Mine were made for me by a friend who used a lathe, but they can easily be fashioned using a coping saw and a hand drill. The bottom end piece was drilled to fit over the end of the mast, in my case ½ inch, but if you are using different mast, change the dimensions to suit. The top stud is a 2 inch 5/16 bolt, passing through the center of the top end piece, and allows the whip to be clamped solidly over this stud, using the screws provided by the whip manufacturer.

After the entire loading coil assembly is completed, place a piece of shrink-tube over the coil and apply heat. This will form a good weather seal and offer protection to the coil windings.

Tuneup of the antenna is simplified by placing the coil on the top section of mast, supporting it temporarily, and adjusting the whip for resonance as indicated by lowest swr. Adjust for resonance 25 kHz HIGHER than you wish to operate, then when the rest of the mast is added, the frequency will be where you wish to operate. If a grid dipper lowered to where you wish to operate. If a grid dipper and impedance bridge are available, they will simplify the procedure. A direct connection to 50 Ohm coax was found to be satisfactory, and no elaborate matching system needed. My antenna showed 1.2 to 1 at resonance. In use, the antenna will show a VERY narrow frequency range, on the order of 8 kHz plus and minus the selected frequency for an swr below 2 to 1. However, this is not too bad on 160, since the band is most active on the bottom 1.800-1.825. Any segment which is active in your area may be selected and the loading adjusted for that frequency. (1)

The best available ground should be used. A rod driven a few feet into the ground is useless except for lightning protection. Use a connection to a cold water pipe, and at least two 130 foot wire radials, zig-zagged if necessary, to fit the space available. DON'T shorten the wires, even if the space is tiny. If you possibly can, run the radials straight out, and don't bury them unless you must, and then only a scant inch deep. (2) (3) (4).

This antenna works well for local contacts, and does well on DX if the band is quiet. See you on top-band next field day!

(1) See ARRL 160 meter allocations chart available from headquarters free.

(2) 73 Magazine, June 1974, "A Practical Ground System for 160," pg. 51.

(3) Ham Radio, April, 1973, pg. 16. "The Vertical Radiator."

(4) My own footnote; DON'T mount the antenna anywhere but on the ground. Most hams seem to think "if it's higher it's better." Look at the commercial antennas in the Jersey marshes. If it's a vertical it should be on the ground and well grounded, or more accurately, well ground planed.

. . . W2NYU/WA1JJV

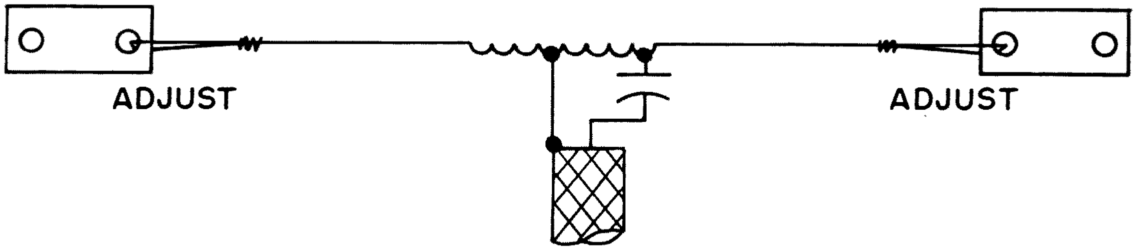


Fig. 1.

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Tavares FL 32778

Pete's Dipole

. . . balun schmalun

Dipole antennas and the method of feeding them are well known among amateur radio operators.

Nothing new under the sun? Well, here is another method of feeding dipole antennas that results in a balanced antenna with a low swr, and it is fed directly with RG-8/U coax. A balun is not necessary to produce a 1-1 match.

Present day transceivers and transmitters are designed for 52 Ohm output-input impedance. With this fact in mind, this antenna was designed to a circuit with a feed point of 52 Ohms.

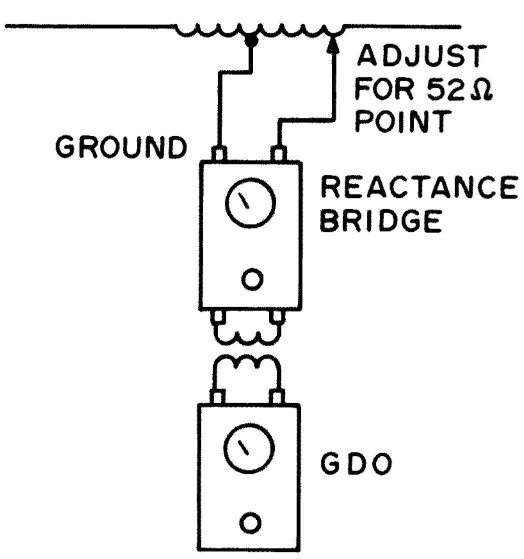


Fig. 2.

Construction is very simple and can be checked out easily and quickly. A great many circuit changes and tests have been made to arrive at the design shown in Fig. 1.

The coil in the circuit is not used as a loading coil but is used in the antenna circuit to determine the 52 Ohm feed point.

Coils for low and medium power are made from 1/8" copper tubing or No. 9 copper wire. Coils for high power are made from ¼" copper tubing. All coils are spaced the diameter of the tubing and all the coils are self-supporting.

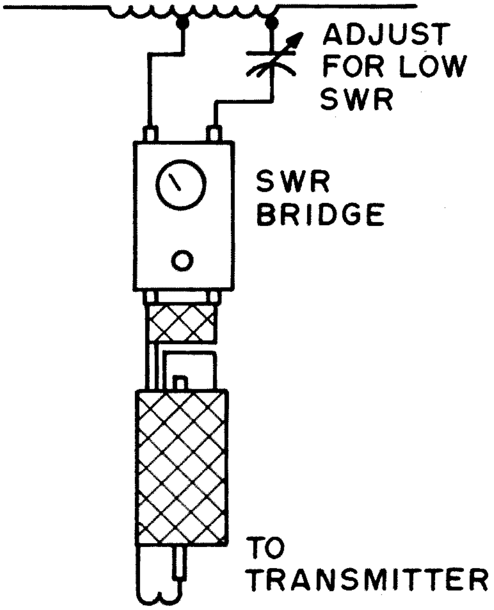


Fig. 3.

The coils are supported by a center insulator or to an insulator that is fabricated from a durable insulating material.

The length of wire needed for each half of the dipole is found by the formula

$$\frac{238}{F_{MHz}} = \text{Length (ft.)}$$

No. 12 solid or stranded copper wire may be used.

A convenient method to determine the antenna frequency is to suspend the antenna about six feet above the ground, supporting the antenna coil on a wooden platform on top of a six foot step ladder. Using the platform for a work table, set a gdo to the desired frequency, bringing it into inductive relationship with the antenna coil. Adjust the length of each element until resonance is obtained, keeping each end the same length.

Locate the center of the coil and solder on a tab there. Connect the reactance bridge and gdo as shown in Fig. 2. With the reactance set at 52 Ohms and the gdo set at the desired frequency, slide the terminal from the reactance bridge along the coil until 52 Ohms is indicated on the bridge meter. At this point solder on a tab.

Before any checks are made of the swr, a variable capacitor is placed in series with one side of the circuit as shown in Fig. 3. This capacitor is used in the circuit to tune out the reactance, and should have a capacity of 7 pF per meter. This capacitor may be left in the circuit or replaced with a fixed capacitor of the same value.

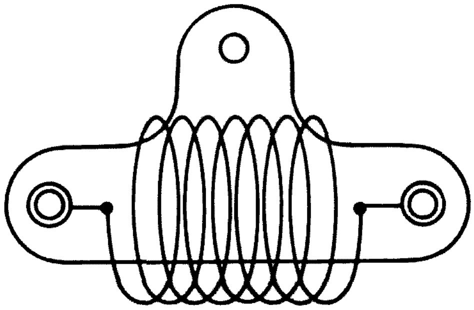
Attach feed line and swr meter as shown in Fig. 3 and adjust the capacitor to the lowest reading swr. Use low power for this operation. You are now ready to connect the transmitter to the antenna and go to work.

PRECAUTIONS

- Be certain that your test instruments are calibrated correctly.
- Do not allow the leads from the coil to droop down along the coil, let them come straight out for an inch or two.
- In construction of the coils be sure the spacing of wire or tubing does not change.
- If you fail to get a low swr do not start to cut the feedline, but check your work and adjustments.
- Seal the ends of the coax so moisture cannot enter.

. . . WA4NWM

Fig. 4.



PORCELAIN CENTER INSULATOR

BAND	DIA.	TURNS
80	2.5"	13
40	2"	9
20	2"	5
15	2"	4
10	1.25"	5

COIL TABLE

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Yes, I've Built Sixteen Log Periodic Antennas!

The broad-band, uni-directional HF Log Periodic beam antenna was originally developed about 1957 (see references at the end of article). Although these very excellent beams are used extensively by Commercial, Military and Government agencies for both medium and long haul circuits, their use has been rather neglected by amateurs.

I have assembled, erected and tested a number of fixed Log Periodic Wire Beams since 1970 with excellent results and would like to pass along some information on these very efficient beams.

It is believed the amateur fraternity may have overlooked or shied away from these antennas due to:

1) Very little information has been published on HF Log-Periodics in ham publications although there have been several articles covering these for VHF and UHF. (Listed in a previous LP article – September 73 issue of 73 Magazine, p. 42.)

2) These antennas are quite complex and are highly mathematical. Several pages of formulas, reference to log tables and four or five graphs or monographs are required for optimum design. This information was best presented to the hams in the May, 1965 issue of 73. Although this covered the design of VHF L–Ps, the formulas also apply to HF.

The antenna manufacturers producing L–Ps for Commercial and Military use, program this data on a computer. By supplying the frequency range desired, gain required, etc., the computer prints out the element lengths, optimum element spacing, boom length, etc., to provide for maximum forward gain, front-to-back ratio, minimum beam width etc.

Although these formulas can be computed manually, several days may be required to design (on paper) an L–P having optimum performance in a given space.

3) Most amateurs feel that Log-Periodics are extremely expensive, which they are if purchased. The least expensive rotatable types by one commercial manufacturer are in the $1500 to $3000 range for a rotary covering 6 to 30 MHz, capable of 40, 20, 15 and 10m operation. Some of these are used by MARS stations. Rotatable L–P ham antennas have recently been announced in the $300 to $1000 class.

The larger fixed types for the 2–30MHz range having higher gain are generally in the 10–30 "kilo-buck" range. However, by assembling smaller, less complicated wire L–Ps for the 14–30MHz range on a "do-it-yourself" basis, one having an 8–10dB forward gain (over a doublet at the same height) can be assembled for a material cost of $15 to $25, not including masts or coax which will vary depending on the particular site. The largest 17-element 14–30MHz L–P being used here, having a 12-13dB measured gain, should cost about $19.50.

4) Many amateurs believe a fixed L–P requires a great deal of "acreage." This is true of the large commercial types having a 10:1 band width or a single beam covering 3 to 30 MHz. These are 63.5 – 127 meters (250' – 500') in length, some even 203 meters (800'). However a 14–30 MHz L–P for 20–15 and 10m having an 8dB gain can

be erected in a space 10.16m (40') wide by 12.7m (50') long. If the length can be extended to 17.78cm (70') the gain can be increased to 10dB compared with a doublet at the same height. By extending to 25.4m (100'), 12–13dB can be realized.

Log-Periodic Types

Log Periodic Antennas can be classified under three general types:

1) The doublet Log-Periodic (DLP) Configuration. Fig. 1 illustrates this type covering a 2:1 (plus) bandwidth suited for a ham beam for 7–14.35 or 14–28MHz.

2) The vertical monopole Log Periodic working against ground or a ground plane counterpoise. Fig. 2 illustrates this type, also covering a 2:1 band width.

3) The trapezoidal zig-zag or saw tooth configuration, Fig. 3. This type being more complicated and not too suited for HF ham applications, will not be covered by this article which will deal only with the first two types.

Before outlining the construction of the doublet and the monopole types, a brief report will be presented covering the tests conducted here over the past four years.

W4AEO Test Results on Log Periodic Antennas

During 1970 the first Log Periodic was put up experimentally here for 20m and 15m only, to be compared with doublets and also a well known "store bought" trap vertical for 40-20-15 and 10m (using separate radials for each band). The vertical had given fair results for DX, evidently due to its low angle of radiation and its 8.9m (35') height (at the base) above ground.

The first L–P was quite simple, using only 7-elements for 20 and 15m and only 9.7m (38') in length. It is supported at the rear end by the peak of the roof, 10.2m (40') above ground, and the forward end by two cedar trees about 11.4m (45') high. It is beamed South as I had been working friends in South and Central America also interested in improving beam antennas. They were capable of making good comparisons with the non-gain antennas previously used.

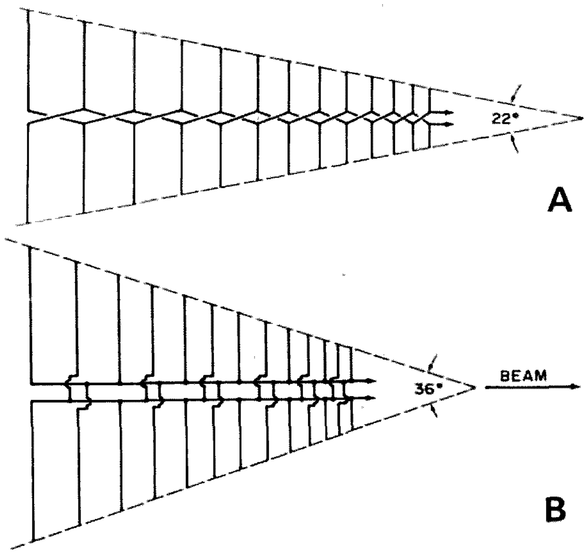


Fig. 1. Doublet log periodic configuration. This will cover a 2:1 bandwidth, say 7-14 MHz or 14-28 MHz. (a) has a 22° aperture angle and gives about 10 dB gain. Note the criss-cross method of transposition of the feeder. (b) is shorter, with a 36° aperture and about 8 dB gain. Note alternate method of transposition of the feeder.

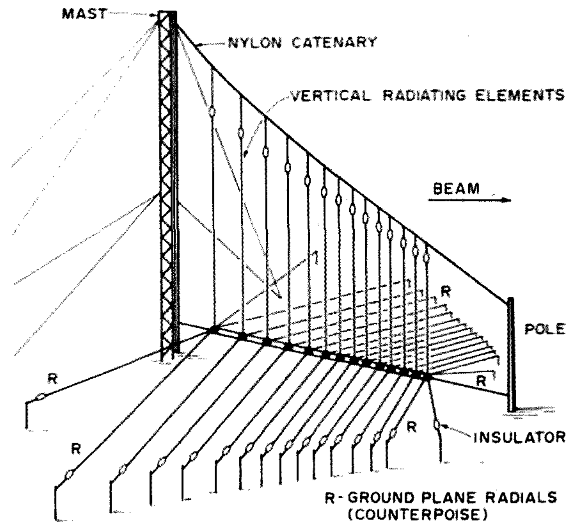


Fig. 2. Vertical monipole log periodic – 2:1 bandwidth.

The results of these first tests amazed me and also the stations being worked. Reports on the non-gain antennas (at the same height as the L–P) normally gave reports of S8–9 on 20m from these stations. I used a popular transceiver operated "bare foot." Switching to the L–P, these stations would generally report an increase of two S-units, or at least a 10 dB increase over the doublet. Usually, when the doublet was giving S–9, they would give "20 over" on the L–P. Although a 20dB gain would seem exaggerated, the "S" meter at this end

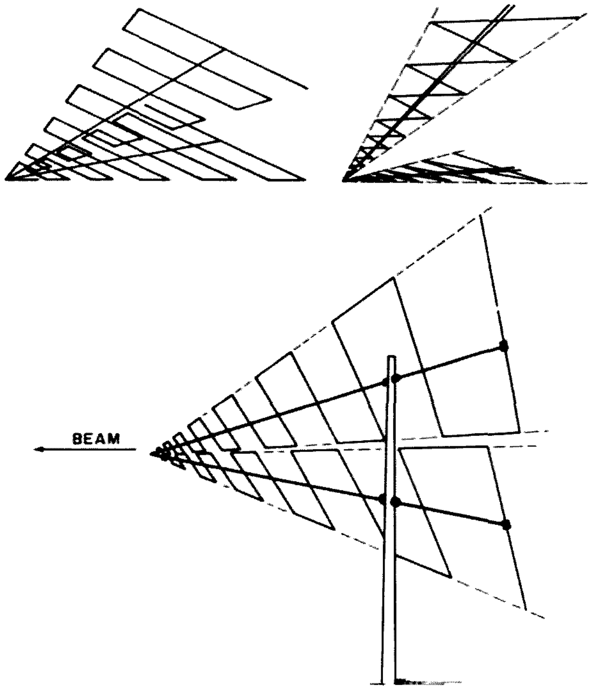


Fig. 3. Trapezoidal log periodics.

would generally confirm this increase on their signal when switching to the L–P.

It is realized that many "S" meters exaggerate but most are fairly linear and can be used for *relative* comparisons at the lower levels. Further the "S" meter here correlated very closely with the gain figures reported when switching to the experimental L–P.

Although the original L–P, Fig. 4, would only have a theoretical gain of 8–10dB, L–P gain figures are often based on VHF or UHF models tested over a line-of-sight path. It is noted that one of the large manufacturers of Commercial and Military HF Log Periodics (see reference B), rate their 10–12dB gains *"over average soil conditions."* It is therefore believed that this first experimental L–P gives an honest 8–10dB gain by averaging the many reports received from various stations to the South over the past 4 years. The "S" meter on the receiver here is quite "Scotch." Generally, if a station reports a two S-unit or 12dB increase when switching from the doublet to the L–P, the "S" meter here normally shows the same increase in his signal.

Since the original simple 7-element (L–P #1) for 20 and 15m was put up in 1970 it has continued to give excellent results and is still being used as of this writing. Several others having more elements and greater length, providing greater gain, have been put up and thoroughly tested. Briefly, these are (in the order tested):

L–P #2. 12-element, 17.8m (70') in length for 20–15–10m. Now being used for the NE beam for W1s, W2s and Europe.

L–P #3. 12-element 6.35m (25') length for 15–10–6m.

L–P #4. 12-element, 10.16m (40') length for 20–15–10m.

L–P #5. (#2 tested on edge in the vertical plane or vertically polarized for about two weeks).

L–P #6. 13-element, 22.86m (90') length for 40–20–15m. This was a "skip band" type with a portion between the the 40 and 20m bands omitted. Two of these are now being assembled for permanent North and South beams.

L–P #7. 5-element, 12.7m (50') length for 40m only. (See reference 18).

L–P #8. Two 5-element (same as #7) for 40 only; back-to-back in an inverted V configuration suspended by a single center support line. One beamed North, one South – exactly 180° difference. Put up to obtain additional and more accurate forward gain and better front-to-back data on 40m.

L–P #9. Improved 5-element, 40m only at increased height for additional forward gain data. Aimed South. Gave consistent 10dB gain over doublet "standard" at same height.

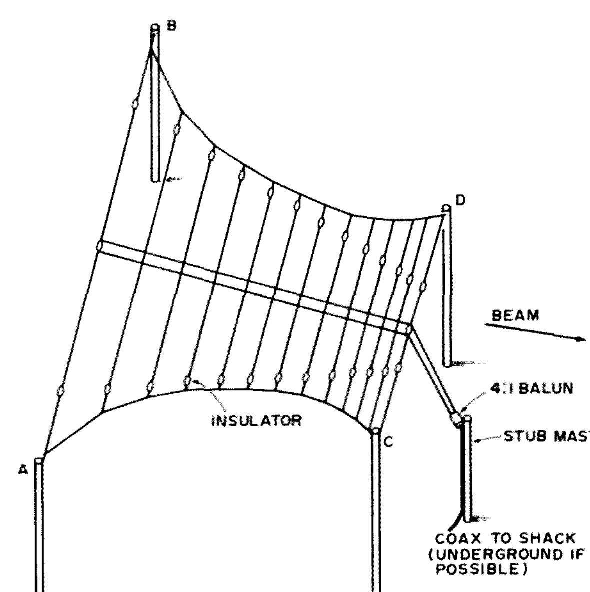


Fig. 4. For method of transposing the center feeder see Fig. 1b and Fig. 6. Illustrates the four masts used to support the antennas.

L–P #10. 5-element 10m monoband L–P. (See reference 18.)

L–P #11. 17-element, 25.4m (100') length for 20-15-10, 15.24m (60') above ground. This is the permanent West beam which has a measured 12–13dB forward gain to the West. By far the best and highest gain L–P installed here to date. Side attenuation is down 25–30dB.

L–P #12. 6-element, 12.7m (50') length. Experimental for 20m only. 10dB gain. Four additional forward parasitic directors (non-driven) were added later but little if any increase in gain could be noted.

L–P #13. 5-element vertical monopole Log-P for 40m only, using ground plane radials or counterpoise. Although this L–P gave a 10dB gain, it had an extremely low angle of radiation. Was good for DX but horizontal doublet type. L–P #7 or #9 was better for normal operation.

L–P #14. Same as #13 except inverted as an "up-side-down" inverted ground plane. Strictly an experimental antenna to try for an even lower angle of radiation.

L–P #15. 5-element vertical monopole Log-P for 80m only. Results similar to 40m monopole, L–P #13. Good for DX but poor for close by stations. Gave 10dB gain (over 80m doublet at 11.43m, 45') from stations greater than 1500 miles.

L–P #16. Trapezoidal L–P for 20 and 15m only, both the zig-zag and the saw-tooth types tested.

In addition to the above L–Ps designed and tested here, several other directional antennas were erected for comparison with the L–Ps. Some of these were:

1) A 6-element 15m "Long John" yagi mentioned below.

2) A 20m phased beam consisting of two 1/2λ's in phase, collinear with two collinear reflectors and two collinear directors beamed toward Europe. Although this showed approximately a 10dB gain, the lobe was much more narrow than the NE L–P and the band width quite narrow. At ± 50kHz, the SWR exceeded 1.5:1.

3) A 5-element Bruce array on 20m beamed for Caracas. The gain was lower than any of the L–Ps tested in that direction or possibly, being vertical, the angle of radiation may have been too low for this distance. It was only tested a few weeks.

In addition to the ham L–Ps assembled here, several other L–Ps have been designed "on paper" for friends and others, one covering 12–24MHz for several MARS frequencies as well as 20 and 15m. Several commercial L–Ps for 3–30MHz, 2–4, 4–8, 6–12, 8–16MHz and several VHF and UHF for 30–50, 140–145, 150–470 MHz, including two for TV: 174–215 and 475–750MHz. Several have been completely assembled for others on "custom built" orders.

YV5DLT – W4AEO Tests

The most accurate 20 and 15m tests have been made with my long time friend YV5DLT (ex-W5DLT) of Caracas. We have been constantly testing the L–Ps for several years. He is able to give very accurate readings on any changes made here.

During the original testing of the first three L–Ps, schedules were kept daily between 1200 and 1400 local time here as these hours gave the worst case conditions on 20m. Other schedules were kept on 15m.

It was during this period that the 17.78m (70') L–P #2 and the 15 and 10m L–P #3 were put up for comparison with the original L–P #1 which had performed so well on both 20 and 15m. L–P #3 was especially good during the 15m tests, generally showing 5 dB over L–P #1 and even slightly better than L–P #2; however #3 was aimed at approximately 165°. Caracas is 149° true, 1854 miles Statute. The other two L–Ps were approximately 180°. All three were about the same height above ground.

After several months of 15m tests on #3, we wished to make a direct comparison with a good yagi aimed in the same direction. I assembled a 6-element "Long John" Yagi per (see reference 20, p. 104). This was erected to the side of L–P #3, exactly parallel and aimed in the same direction; both 11.43m (45'), or about a full wave above ground.

Several weeks were spent comparing these two beams. Invariably YV5DLT would report L–P #3, 3–5dB better than the yagi. The "S" meter readings here confirmed this.

40m L–P Tests

Most of the 40m tests were conducted

over a period of several months with old friends, W4QS and K4FBU in Florida at the same time daily. During this period four different 40m L–Ps were beamed South for Florida at various times for comparison with a good 40m horizontal doublet at 11.43m (45'). One 40m L–P #8 was also beamed North for comparisons in that direction. All of these L–Ps produced 8–10dB gain in these directions over the dipole; however, many of the tests indicated as much as a 20dB improvement which was confirmed by the "S" meter at this end and a number of other stations in various parts of Florida.

Since the usual 2-element 40m yagi or two extended 1/2λ's in phase collinear do not normally exceed 3–4.8dB gain, the 10dB average gain of the L–Ps tested is worth considering; especially because of their low cost and ease of construction.

75 or 80m Vertical Monopole L–P Tests

A 5-element vertical monopole L–P, #15, was assembled for 75m. Since the mast height limited the longest rear element (the reflector) to 16.51m (65', ¼λ +5%) this L–P was limited to 3.8 – 4.0MHz, and all tests were within this range.

It was soon evident that this vertical beam was strictly for longer range communications, due to its lower angle of radiation. The ½λ 80m dipole up 45° (not an inverted V) used as the "standard" was better for distances from 400–500 miles. Beyond this range the vertical L–P was better in the forward direction. At night the doublet was better to about 1000 miles; beyond, the monopole L–P would show its increase, giving a good gain over its beam width.

For ranges greater than 1000 to 1500 miles, the 75m monopole, L–P #15, showed at least a 10dB gain over the dipole. However, for the normal working range on 80m or 75m, the doublet was better for the shorter distances.

A similar test using a 5-element 40m vertical monopole, L–P #13, was conducted with similar results as the 75m test. The horizontal doublet type 5-element 40m L–Ps #7, 8 or 9, being better for normal operations and the vertical monopole for DX. This beam was aimed NW.

During a pre-dawn 40m test with L–P#13, a W7 (working a VK on phone) in the NW about, 2000 miles from here, was monitored. On repeated "S" meter readings taken, the monopole was consistently 2 "S" units or 12dB better than on the 40m dipole when receiving the W7 in line with the monopole beam.

Receiving Advantages of the Log–Periodic

In addition to the excellent forward gain of the L–P which is quite apparent to those being worked, the received gain is also quite noticeable. Another plus factor of the L–P is its excellent diversity or "capture" effect during reception.

When QSB is bad on the dipole used as the "standard," switching to the L–P reduces fading considerably, since the "readability" on the L–P is much better.

Evidently the number of elements and its "boom length" produces the diversity effect due to its size and length compared with the doublet or even a smaller 3 or 4 element beam. The greater the number of elements and the greater its length, the better it performs for reception in addition to the increased gain apparent on both transmission and reception.

For those more acquainted with the yagi, the L–P can be considered as a multi-element, uni-directional end-fire array having a driven (rear) reflector, a ½λ driven "active" radiator and a number of forward driven directors.

L–P theory implies that for a given discrete frequency within its bandwidth, 5-elements are generally excited or driven as an "active cell." However, while testing the 17.78m (70'), 12-element, L–P #2, it was excited with low power on 20m. Rf voltage could be detected (using a neon bulb) on *all* elements except the long rear (reflector) element. The second or ½λ driven element (on 20m) was quite "hot" at the ends as would be expected. The rf voltage on the following driven director elements 3, 4 – 11 and 12, decreased gradually toward the forward end. Some rf could still be detected on the short forward element #12.

Evidently these multi-element, driven directors add gain and also possibly help lower the angle of radiation in the E plane

and concentrate the forward lobe in the H plane. This may be the reason the apparent gain generally exceeded the theoretical during tests.

Front-to-Back Ratio

The front-to-back of the L–P is generally less than a well designed mono-band yagi. The L–P seems to be 14–15dB maximum with 10 to 13dB as typical. From the tests made here, the front-to-back improves as the L–P is raised to at least a ½λ above ground (at its lowest cut-off frequency).

The front-to-back of the 40m dipole L–Ps (DLP) tested appeared to be better for the horizontal than the inverted V configuration, as would be expected and the forward gain also better.

The Forward Lobe

The forward lobe of the L–P is generally wider (about 90–100° beam width) than that of a well designed yagi; however, for a large fixed beam this is good as it can be aimed to cover a certain part of the country or a particular DX continent. For example the NE (L–P #2) covers Europe quite well and the 30.48m long, 17-element West beam (L–P #11) seems to cover all of Australia. The side attenuation of this long L–P is down 25-30dB.

A W1, -2 or -3 could use one or two L–Ps to cover most of the states. A W6 with an L–P beamed East would cover most of the East Coast. At this QTH 4 L–Ps will cover most continents of interest: NE, Europe; East, Africa (and Australia long path); SE or South, Southe America; West, Australia; and NW – Alaska, Japan, etc. One for SW may be tried later for long path to Europe.

Fixed Beam Antennas vs Rotaries

An advantage in using several fixed beams over a single rotary is that they can be switched instantly from one to the other (and to the doublet used as a"standard"), whereas, it takes some time for the rotary to swing, making quantitative readings difficult, especially when QSB is bad.

Another item noted during the first year these L–P tests were started: about half the stations worked during the winter of '70–'71, using rotaries, would come back "Sorry OM I can't swing my beam, it is frozen up for the winter." I noted less of this problem the second winter. Evidently better rotators are being used.

The following comments are comparisons of the L–P with several other beams.

Compared with the Yagi

As more hams no doubt use yagis than other beams, these will be compared first. A well designed and properly adjusted 3 or 4-element mono-band yagi should give about the same gain as a moderate size 20-15-10m L–P when both are at the same height above ground. The L–P will, of course, cover all frequencies 14 and 28MHz and can be operated with a comparatively flat SWR any place in the three bands. The band width of a high Q yagi may be limited to a portion of a band as the band width at resonance may be only 2.5%.

Compared with a tri-band yagi for 20-15-10m, which is generally a compromise antenna, the L–P should give the greater gain.

Of all the contacts made while testing these L–Ps during the past four years, not a single station worked (most using yagis for 20, 15 and 10) had a doublet for use as a "standard" or test antenna for comparison with his beam. Many have been most cooperative in rotating their yagis the full 360° to demonstrate the front-to-back, but none were able to demonstrate its forward gain. The front-to-back on some of the mono-band yagis was quite good, while others were very poor.

One MARS station worked had both a rotatable L–P and a yagi. He obliged by rotating the L–P 360° which gave a good demonstration of its pattern. When both antennas were beamed in this direction, the L–P showed greater gain; however, he did not have specifications on the yagi.

An advantage of having several fixed beams for various directions is that they can be selected instantly by a coax switch or relay. This allows for more accurate data in comparing antennas. Even under fading conditions a fair comparison can be made by switching rapidly and averaging the readings.

Compared with a Rhombic

Anyone having room for a rhombic cer-

tainly has room for several L–Ps for various directions and is then not limited to one direction as is the rhombic.

The TCI engineers (Technology for Communications International of Mountain View CA) advertise their "Extended Aperture" L–P which is only 60.98m (200') in length and has a gain of 17 dBi. A rhombic to produce this gain requires a length of 518.29m x 228.66m (1700' x 750') width according to the TCI ads.

Further, the gain of a rhombic generally decreases at its low frequency end (less wavelengths per leg), whereas, the gain of the L–P is approximately the same over its bandwidth. If anything, at least from the tests here, the L–P seems to give slightly better gain at the low frequency cutoff end. The forward lobe of the L–P is generally wider than the rhombic, requiring less accurate aiming than the latter.

Compared with Phased Arrays

To date I have only made comparisons with two phased arrays on 20; a 5-element Bruce and a 6-element collinear array mentioned above, both strictly single band antennas. Neither gave the performance of the L–Ps. I do plan to test the L–P vs a multi-element Sterba curtain or similar stacked arrays later.

The SWR of Log-Periodics

As a general rule the SWR of a L–P does not exceed 2:1 over the band width for which it is designed, i.e., 14 – 28MHz. From the tests here, the SWR over an entire band, 7.0–7.3; 14.0–14.35 or 21.0–21.45 does not exceed 1.5:1. Table 1 gives some of the readings taken from several of the L–Ps tested. (Also see reference 18 for SWR readings taken on the mono-band L–Ps.)

Log-Periodic Site Selection

The first step is to determine if space is available for the L–P when beamed in the desired direction. The second step is to decide the desired band width or the bands it must cover and the gain desired. These will, of course, determine the size (length) of the L–P and if it will "fit" the space available.

The long rear element (reflector) must be at least 5% longer than the lowest cutoff

Table 1

SWR Readings

kHz	LP #1 7-element 20 & 15	LP #2 12-element 20–15–10	#11 17-element 20–15–10	kHz	#9 5-element 40 only	LP #15 5-element monopole For 80m only
14.0	1.1:1	1.4:1	1.4:1	3.5	NA	1.2:1
14.1	1.1:1	1.5:1	1.4:1	3.6		1.2:1
14.2	1.02:1	1.6:1	1.3:1	3.7		1.1:1
14.3	1.02:1	1.7:1	1.2:1	3.8		1.2:1
14.35	1.01:1	1.7:1	1.1:1	3.9		1.4:1
				4.0		1.25:1
21.0	1.01:1	1.1:1	1.3:1	7.0	1.05:1	
21.1	1.01	1.2:1	1.15:1	7.1	1.05:1	
21.2	1.05:1	1.3:1	1.05:1	7.2	1.01:1	
21.3	1.15:1	1.4:1	1.01:1	7.3	1.1:1	
21.4	1.25:1	1.4:1	1.02:1			
21.45	1.3:1	1.5:1	1.1:1			
28.0	NA	2.0:1	1.5:1	*Also see SWR readings for mono-band L-Ps, Aug 1973 issue of 73 Magazine, p. 23 and 24.*		
28.2		1.5:1	2.0:1			
28.4		1.6:1	2.25:1			
28.6		1.6:1	2.0:1			
28.8		1.8:1	1.3:1			
29.0		2.0:1	1.01:1			
29.2		1.6:1	1.5:1			
29.4		1.6:1	2.0:1			
29.6		1.4	2.0:1			
29.7		1.3	2.7:1			

frequency. The short forward element should be 50% shorter than the high frequency cutoff. The pages of math required for their complete design will not be presented here. (See reference 2, 3, 4, 5, 8, 11 and 13.)

To simplify the design and eliminate the formulas entirely, Table 2 presents in tabular form some of the doublet type L—Ps (DLP) assembled and tested here for the ham bands as mentioned above. (Dimensions for single band L—Ps were given by reference 18.)

This tabulation gives frequency band width, element lengths and element spacings, overall (boom) length, apex angle, etc. of each.

Similar information on the vertical mono-pole L—Ps for 40m and 80m is supplied by Fig. 10.

If space is available for a L—P at your QTH, at least one of these can be tried.

Fig. 4, is sketch illustrating four masts used to support a typical DLP for 20-15-10m. These masts can be inexpensive 12.20m (40') collapsible guyed TV masts, power poles, towers, trees (as used here) or other supports if available.

Fig. 5, illustrates two high and four stub masts for an inverted V-Log-P which I call my "Λ-Log-P" configuration.

Fig. 6, illustrates a simple 5-element mono-band L—P which requires the least space. This is especially adapted for 40m. (See reference 18 for complete information.)

Fig. 7, illustrates an "acreage saver," using a DLP on edge in the vertical plane. This only requires one high and one lower mast and little width.

This one is only suited for the higher bands due to the rear mast height. The vertical DLP will usually have a lower angle of radiation than an equivalent horizontal DLP. It will generally not be too good for

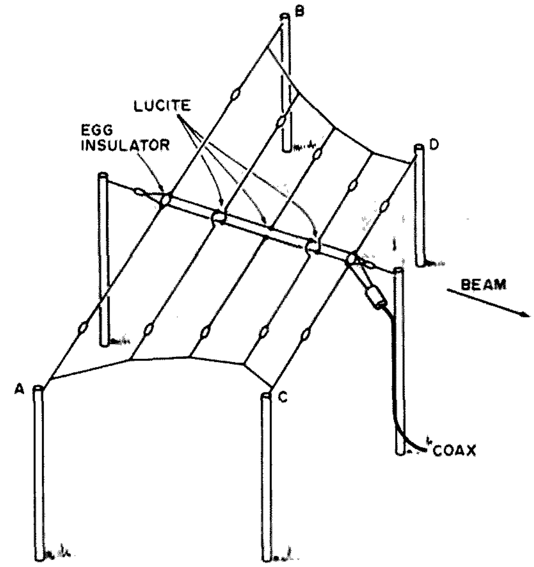


Fig. 6. Five element monoband log periodic — fine for any band 10 thru 80m — see the Aug. and Sept. 1973 issues of 73 Magazine for details.

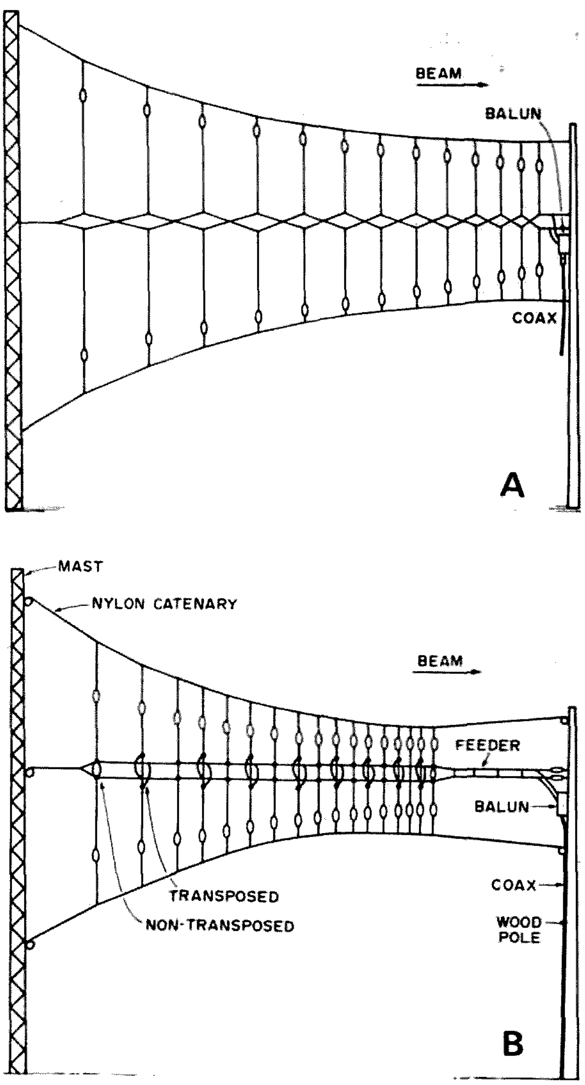


Fig. 7. Vertical dipole log periodic — acreage saver model.

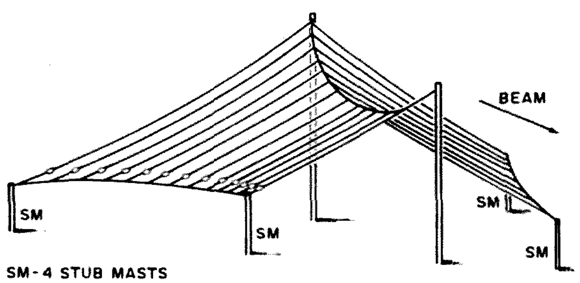


Fig. 5. W4AEO inverted Vee log periodic.

short-haul on 20m or 15m but might be better on longer, multi-hop circuits. The one tested here worked extremely well on 10m.

Being vertically polarized, it is more subject to man-made QRM. This type is only suggested as a space saver or possibly mounted on the roof of a building where length may be available but with insufficient width for a four mast horizontal DLP.

Fig. 8, illustrates a single band vertical monopole L–P using ground radials suited for a 40m or 80m beam.

The advantage of the monopole is that only a single high rear mast is required (which might be the tower for a rotary beam) and a shorter wood pole for the forward mast. As the vertical radiating elements are only ¼λ, the rear mast can be approximately one half that required for a vertical DLP, Fig. 7, for the same frequency. A rear mast height (for Fig. 8) of 15.24m (50') is required for 40m and 22.87m (75') for 3.8-4.0MHz or 24.39m (80') for 3.5–4.0MHz.

The disadvantage is that at least 30% more antenna wire is required for the monopole L–P using ground radials compared with a DLP.

A vertical beam of this type should have an open area in the direction of the beam. Aiming toward a hill, heavy wooded area, etc., should be avoided due to its low angle of radiation. From the tests made here, a two or three story dwelling in the beam's path seems to give about 5dB attenuation. No doubt the plumbing, electrical wiring or air conditioning ducts either resonate or give sufficient screening to cause this attenuation. It is, therefore, suggested that vertical beams be used only on open terrain, having good ground conductivity. Avoid trees or other obstacles in the path of the beam.

The ideal location for a vertical beam of this type would be at a coastal area as near the shore line as possible with the beam aimed seaward toward a DX continent. Those lucky enough to have such a location would no doubt have excellent results with a monopole L–P having a 10dB gain on 40m or 80m. One aimed across a lake might also be good.

A vertical monopole for both 40m and 80m of the "skip band" type is not out of reason but would require at least 45.73m (150') in length by 42.68m (140') or 6,042.44m^2 (21,000 sq. feet) of open space which is quite an area except for one lucky enough to live on a ranch or farm.

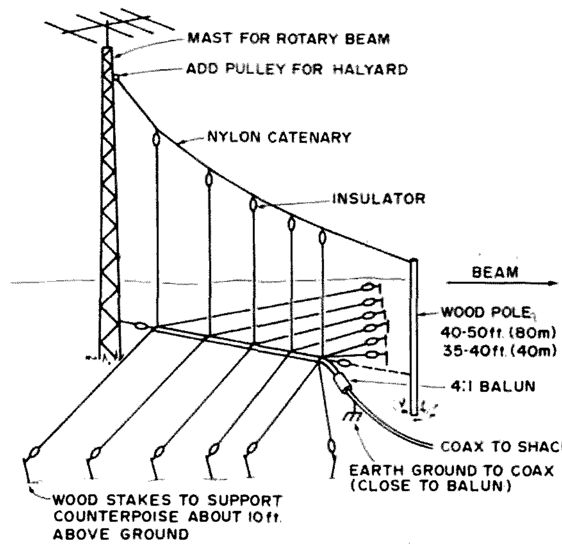


Fig. 8. Single band vertical monopole – for 40 or 80m. About 10 dB gain.

The following is a step-by-step procedure for assembling simple, inexpensive 2:1 bandwidth DLPs for 20-15-10m, single band L–Ps for 40m or 20m and 40m or 80m vertical monopoles.

Log-Periodic Assembly Procedure

After determining if there is sufficient area for the L–P when aimed in the desired direction, it is suggested that a scale drawing be made showing the proposed mast locations for the L–P as it will be when suspended from the masts. By drawing this to scale, it is quite easy to determine any needed or unknown dimensions.

Next procure the necessary material for the L–P selected. Fig. 9 illustrates the construction or assembly of a typical DLP and Fig. 10, the monopole L–P configuration.

Note that for the long rear element (#1) and the short forward element of a horizontal DLP, small ceramic egg type compression insulators are used as these two end elements carry most of the load or strain of the center 2-wire open feed line and its center insulators or spacers. The latter are home made from .64m (¼") thick Lucite or Plexiglass. This can usually be purchased at hardware, building supply or radio stores.

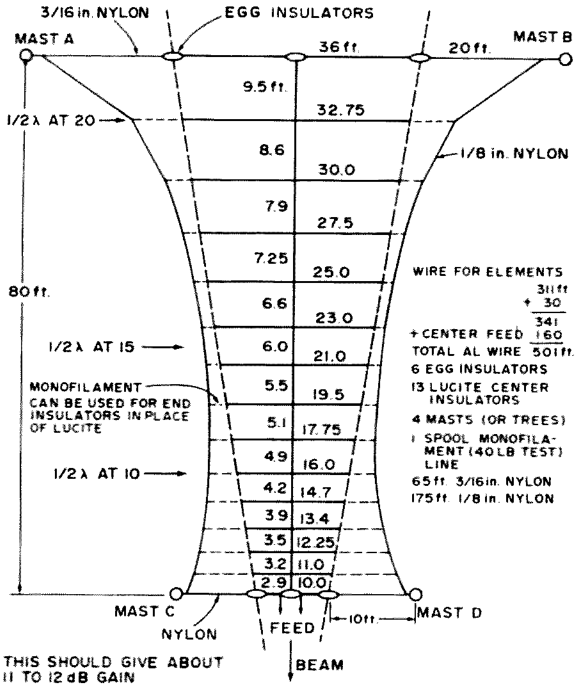


Fig. 9. 15 element 20/15/10m periodic.

The Lucite is cut into strips 1.59cm wide x 15.24cm long (5/8" x 6"). These are then drilled to make three type insulators for the L–Ps, which are:

1) End insulators for all elements (except the front and rear as mentioned above). Two holes are drilled in this type.

2) Center insulators for the DLP center feeder which serves as the center insulator for all elements (except front and rear), also supporting and spacing 10.16cm (4") the 2-wire center feeder. 4-holes drilled.

3) Center insulator for the monopole L–P. Same as the DLP type except these have an extra center hole for securing to the ¼λ vertical elements. For this type the two outside holes are for securing the ¼λ ground radials or counter-poise.

The hole spacings for above are illustrated in Fig. 11. These are all the same size to simplify production.

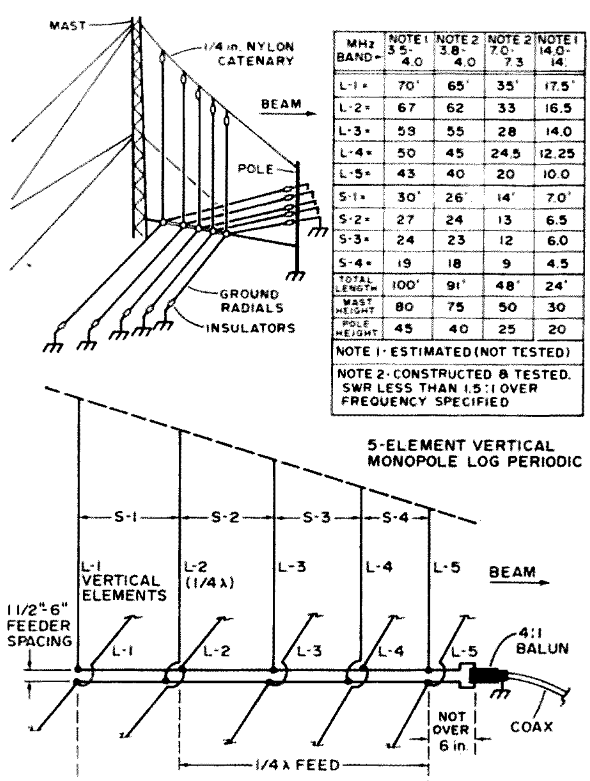
Lucite is used for these as it is difficult to locate a ceramic insulator of this type. The Lucite is light in weight, easy to cut and drill, low loss and less expensive than commercial insulators. They average 10 to 20¢ each. Hundreds of these have been used on the L–Ps here. Only one has broken after four years of use.

The importance of transposing between elements can not be stressed enough. This is accomplished either by criss-crossing the feeder as illustrated in Fig. 1a or by transposing the feed to the elements as illustrated in Fig. 1b. Both work equally well in providing phase reversal to alternate elements. The latter method is better suited for wire beams from a construction standpoint as shown in Figures 6 and 10. This method has been used here for all but one L–P. It is the method generally used for the large commercial L–Ps.

An L–P is in effect a multi-element end-fire array and *must have a phase reversal between adjacent elements* as with any end-fire array (example, the "ZL Special" or the "W8JK.") If there is no phase reversal between elements, you do not have an L–P.

Briefly, an L–P is similar to a yagi except all elements are driven. The "active" section of an L–P consists of a rear driven reflector, a driven or "active" ½λ radiator, and a number of driven forward directors. It must, therefore, function as an end-fire array. If the adjacent elements are not approximately 180° out of phase, there will be no forward lobe or gain.

Several have written that their L–Ps were non-directional and gave no gain. After



MHz BAND→	NOTE 1 3.5-4.0	NOTE 2 3.8-4.0	NOTE 2 7.0-7.3	NOTE 1 14.0-14.
L-1 =	70'	65'	35'	17.5'
L-2 =	67	62	33	16.5
L-3 =	59	55	28	14.0
L-4 =	50	45	24.5	12.25
L-5 =	43	40	20	10.0
S-1 =	30'	26'	14'	7.0'
S-2 =	27	24	13	6.5
S-3 =	24	23	12	6.0
S-4 =	19	18	9	4.5
TOTAL LENGTH	100'	91'	48'	24'
MAST HEIGHT	80	75	50	30
POLE HEIGHT	45	40	25	20

NOTE 1 - ESTIMATED (NOT TESTED)

NOTE 2 - CONSTRUCTED & TESTED. SWR LESS THAN 1.5:1 OVER FREQUENCY SPECIFIED

Fig. 10. 5 element vertical monopole log periodic.

checking, it was found they failed to transpose.

Antenna Wire

Because the forward and rear elements and the 2-wire center feed line are the only portions requiring a strain type wire, these should be #7/22, #7/24 or #14 copper or copper clad.

All of the other elements can be #16 soft drawn bare copper, enameled or tinned (hook up) wire. This can be purchased economically in 304.88m (1000') spools. Even #18 has been used here which seems entirely satisfactory; at least to 500W. This saves weight and cost.*

Since an L–P has a lower Q than a yagi, there is not the high rf current in the elements. The yagi generally requires tubing whereas wire is entirely satisfactory for an L–P. Wire is used for the large commercial or military fixed L–P antennas (reference A, B and C). Further, since there are several "active" elements per band, the rf current is no doubt distributed over several elements, therefore, wire is entirely satisfactory.

Soft drawn wire is suggested for all elements except #1 and the short forward element since there is practically no pull on the remaining elements. Being soft drawn, the wire will not tend to coil up or kink as does hard drawn or some of the copper clad. There is enough tension on the forward and rear elements to prevent this problem.

After all material has been collected, and the Lucite insulators fabricated, proceed as follows:

1) First assemble the two wire center feeder.

Select two sturdy posts, trees or other supports with about 1.53cm (5') greater separation than the required length of the center feeder for the L–P selected. Secure one end of the pair to or around the post at a height of approximately 1.83m (6') above ground level. Now thread the center Lucite insulators on the 2-wire feeder at the free end. This end may now be secured to the second post or tree. Stretch the two wires so they will be parallel and separated about 20.32cm (8") at the support ends. They will tighten to 10.16cm (4") separation after the center insulators/separators are spaced. They should be at about shoulder height to make for easy assembly. If necessary, two turnbuckles can be used temporarily at one end to tighten the two parallel wires and to adjust them for equal tension.

* A number of the L–Ps here have been constructed entirely of aluminum wire (#15 electric fence wire, Sears Cat. No. 13K22065). This is quite inexpensive compared with copper; 402.44cm (1320') roll at $8.70. The aluminum is also used here to reduce weight since trees are used as the "masts."

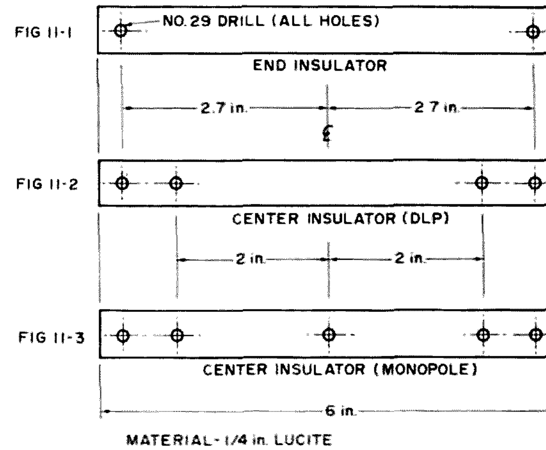


Fig. 11. Hole spacings for the insulators.

Now slide the center insulators (spacers) and distribute along the feeder in their approximate locations as given in Table 2. Starting at one end mark or indicate the location where the 2-wire open feeder will be attached to the center of the long rear element #1. A piece of 2cm (3/4") masking tape can be used on each of the two wires to indicate this starting point, which should be about 30.48cm (12") from one of the end supports. The #1 element will be located at this starting point.

Now measure from this point with a steel tape the first spacing distance, S1 which will separate Elements #1 and #2. The first Lucite center insulator will be located at this point (location of the second element, #E2). This insulator is held in place between the 2-wire feeder by means of a few turns of 2cm (3/4") masking tape served on either side of the Lucite insulator on both wires. Allow a slight distance or "play" on each side of the insulator so the tape will not be snug against the insulator. The wires should be able to turn free in the insulator holes. This helps keep the 2-wire line from twisting after the antenna is completed. The masking

tape hardens after a few days in the weather and prevents the center insulators from sliding on the wires, which would alter the correct spacing of the elements.

Next measure the spacing distance, S2 and secure the next center insulator. Continue measuring and securing the insulators until all are in position. Then measure the last spacing distance and mark with tape as was done for the starting, #1 element. This last marking will be the location of the shortest end element (egg insulator) and will also be the feed point to the L–P.

The distance from the back side marking to the last forward marking will be the overall length (boom length) of the L–P and will total the spacing distances, S1 + S2 +S3. . .etc. It is suggested that this total length of the center feeder be measured to make certain no errors have been made in any of the spacing distances. This total length is given in Table 2.

2) The next step will be cutting the various elements (or doublets) to length; L1, L2 etc. It is suggested that the rear element #1 and the short forward element be cut last as these will not be connected to the feeder until all of the other elements are cut and secured to the center insulators; thus leaving the feeder attached to the supports for convenience until all except the forward and aft elements are in place, connected and soldered to the feeder.

In addition to the actual element lengths, allow several centimeters for connecting to the end insulators and about 25.4cm (10") extra for the center connections from the element center ends to the 2-wire feeder, as *every other element is transposed* as illustrated in Fig. 1b and 9. By using a continuation of the element centers, it eliminates an extra splice.

An odd number of elements is recommended since this allows the 2-wire feeder to be connected directly (non-transposed) across the center (egg) insulators of the end elements. (Reference 18.)

Also note that the rear of the center feeder is "fanned" or separated at the rear element (reference 18). This helps in keeping the two feeder wires separated on the longest rear (S1) span, especially important for lower frequency L–Ps. This precaution helps prevent the two feeder wires from becoming twisted or from touching during a high wind. Additional Lucite spacers between S1+S2 and possibly S2+S3 may be necessary for 40m, or even 20m L–Ps. This can usually be determined after the L–P is finally assembled at the 1.83m (6') level.

3) After the elements are cut to the various lengths, they can be attached to the center Lucite insulators, starting with element 2. The connections from the elements to the feeders can be made after all elements (except the rear and forward elements) are secured to the center insulators. *Note that every other element is transposed,* i.e., Element 1, non-transposed; #2, transposed; #3, non-transposed. . .etc.; or *all even number elements transposed* and *uneven numbers non-transposed.*

Fig. 11 illustrates the Lucite center insulator, the transposed and non-transposed method of connecting the element center ends to the feedline and the method of connecting the feeder to the short forward element and the long rear elements which use the egg strain insulators.

4) After the elements (except forward and rear) are attached to the center insulators and in turn connected to the feeder, all joints can be soldered while the center feeder is still elevated 1.83m (6').

The ends of the center feeder can now be removed from the 1.83m (6') supports and lowered to the ground. The feeder can now be attached to the rear and forward elements and soldered. Spread the complete L–P on the ground at its approximate location (when aimed in the desired direction) between the four masts (DLP type) from which it will be suspended.*

Nylon Catenary Support Lines

The DLPs used here are supported by two catenary side lines shown in Figures 4 and 6. These are stretched between masts A-C and B-D and the L–P suspended between these. Nylon line, .32cm (1/8") is used. .48cm (3/16") nylon is used for supporting the

* For some of the L–Ps, I have used monofilament fish line (40 or 50 lb. test) in place of the Lucite end-insulators to reduce weight, cost and fabrication time for the Lucite insulators. The line used was Sears Cat. No. 6KV32232 (40 lb. test).

long rear element, #1 and the short forward element as shown in Fig. 4, 6 and 9. Nylon does not shrink when wet or stretch when dry as does most rope. Further nylon will not rot and should last several years. After four years in constant use here none of the nylon line has broken.

The next step is to suspend the L–P between the two catenary side lines.

At this point the L–P has been assembled and is spread out on the ground between the four masts or other supports, aimed in the beam direction. It should now be raised 1.83 – 3.05m (6 – 10') above ground level and suspended at this height between the masts to be used in its final full height position. By using these masts, all angles and distances will be the same as when the L–P is hoisted to its maximum height.

The long rear element, #1, and the short forward element are attached to the .48cm (3/16") nylon line which supports the rear element between supports A & B. The short element is stretched between C & D.

The .32cm (1/8") side catenary lines or bridles are now stretched between A & C and B & D. Actually these are supported A–B and C–D, however, these splices will be near the masts; the .48cm (3/16") lines carry all the load and will be tied to the mast halyards.

Next, add the Lucite end-insulators to all elements except #1 and the short forward element. These use the egg strain insulators.

Now, starting with element #2, tie short lengths of #18 (165 lb test) nylon cord to the end insulators. These will in turn be tied to the side catenary lines, A–C and B–D. Element #2 will then be suspended between the side bridles.

When first tieing these element support cords to the catenaries, make a knot which can be easily untied. It may be necessary to adjust the tension on the various elements several times before they are correct and the catenary lines start taking their proper "suspension bridge" shape as shown by Fig. 4, 6 or 9.

Elements #1 and #2 should be parallel, by making certain that their end spacings are equal to the center spacing, S1. After element #2 has been attached and adjusted parallel with #1, proceed to suspending and adjust element #3 and the following elements, #4, #5, etc., until all are suspended between the side bridles. As these are attached, the catenaries will start taking on the shape of a commercial L–P.

Adjusting the tension of the elements between the side lines is the only "cut-and-try" procedure required for the L–P assembly. When constructing your first L–P it may require several tries but it will soon assume the correct shape illustrated by Figures #4, #6 or #9.

Note: All elements other than the rear #1 and the short forward element will have some sag. This does not seem to affect the operation. If the elements are pulled too tight between the side support lines (to try and level the elements), too much strain will be placed on the side lines, possibly requiring larger line and even sturdier masts.

There will also be some sag of the center feed line sagging toward the center. This shows no ill effect in the L–P's operation. Some sag or "give" in all elements (except the long #1 and the short forward element) is desirable. If all lines are too tight, they might break during heavy icing conditions.

None of the L–Ps here have come down over the past four years. During this time there have been three heavy ice storms. The L–Ps sagged almost to the ground from the ice build-up. As soon as it melted they returned to their normal height. They have also withstood several high winds without damage.

After all element support cords (#18 nylon) have been adjusted (and readjusted) several times so the sag of these are approximately the same, all elements parallel, and the side lines appear identical and have a similar catenary "curve" as in Fig. 4, the cords can be secured permanently to the side lines.

I suggest that a few turns of 2cm (3/4") masking tape be served on the .32cm (1/8") side lines on either side of the #18 nylon support cords. This will prevent the latter from sliding out of place along the side lines after the antenna has been raised.

Before raising the L–P to normal height on the masts, an SWR should be run while the antenna is still 6 to 10 ft above ground. Proceed as follows.

Feeding the Log-Periodic

The simplest method of feeding the L–P is to connect the high impedance balance winding of a 4:1 broad band balun at the feed point (short element end). The coax is then connected to the balun. Two other feed methods will be presented later but the 4:1 balun method is the easiest for running the initial SWR before raising the L–P to full height.

A low powered transmitter or transceiver should be placed on a box or table directly under or a short distance in front of the short element feed end. Connect a short length of coax from the 4:1 balun to the SWR meter and another short length to the transmitter or transceiver.

An SWR run should be made over each of the bands for which the L–P has been designed to cover. Readings should be taken at least every 100kHz over each band. Record these for comparison with a second SWR run to be made after the L–P has been hoisted to full height and the final length coax used between the antenna and the shack is positioned.

While the L–P is still at a workable height it is interesting to check the element ends for rf voltage on each of the bands. Either a small ¼ watt neon or a "sniffer" can be used. This test will give one a better idea as to the operation of the L–P.

If the SWR readings are 2:1 or better, the L–P should be O.K. after it is raised to full height. Generally the SWR readings will improve after being raised higher above ground. They should then be similar to the SWR examples given by Table 1 (and reference 18).

Other Feed Methods

The feed method mentioned above using a 4:1 balun directly to coax is the simplest and is recommended; however, two other feed systems can be used:

1) Tuned open line from shack directly to the L–P feed point. This, of course, requires a tuner at the shack which must be returned when changing bands. The tuner with open line is O.K. for a mono-band L–P but is a nuisance when more than one band is used.

2) 300Ω TV flat line can be used from the L–P feed point to the shack, then the 4:1 balun and coax to the set. This is the method used here. Since trees are used as "masts," RG-8/GU or RG-11/U coax is too heavy, causing the L–Ps to sag. The 300Ω TV line seems entirely satisfactory for low power "bare foot" operation. Further the TV line has extremely low loss if properly terminated and is quite inexpensive for long runs. Some of my L–Ps use over 107m (350') of TV line between the L–P feed point and the 4:1 balun.

After the final method of feed is selected, it can be connected permanently to the L–P feed point.

The beam is now ready to be hauled up to maximum height by the mast halyards. After the L–P is in place, another SWR should be run over each band and compared with those run at the lower level. They should not exceed 1.5:1 over any band (or any frequency within its band width, if necessary test equipment is available to make measurements outside the ham bands).

A doublet at the same height and broadside to the L–Ps beam should be used as a "standard" or test antenna for comparing gain in the forward direction.

Monopole Log Periodic Assembly

The assembly and erection of the monopole L–P configuration is similar to the DLP. Fig. 8 illustrates the general construction for either a 7.0-7.3 or 3.5-4.0MHz monoband monopole L–P. Fig. 10 gives element lengths and spacing distances for 40m and 80m.

A single catenary line is run from the high rear mast to the shorter forward mast, .64cm (¼") nylon line is suggested. The 5 vertical elements are suspended from the support line. Note the "suspension bridge" shape of the catenary illustrated by Figures 2 and 8.

The short forward mast should be a wood pole or any other non-metallic support since it is directly in the line of fire of the vertical beam.

Note that the ground radials decrease in length from the rear end (below the longest rear vertical reflector, element #1.) to the #5 forward element, the radials being the same length or slightly longer than their ¼Ω vertical elements.

The radials should be about 3.05m (10') above ground to allow access under them. Although the radials can slant down from the center feeder, the ends should be high enough to prevent contact as some are quite "hot" with rf.

The 2-wire feed line is identical to the DLP type; however, the elements connected to and supported by the Lucite center insulators (Fig. 11) are arranged differently in that the two outside holes are for the two ¼λ side radials and the center hole is for the ¼λ vertical element. Actually the center insulator and the 2-wire feeder are suspended by the 5 vertical radiating elements and they in turn by the single catenary line. Fig. 10 illustrates these elements, showing the jumper connection between the two side radials. Transposition or the "criss-cross" feed is accomplished as illustrated in Fig. 10.

The suggested method of feed is by the 4:1 balun, then to coax. Be sure the coax shield is grounded to an earthground as near the balun as possible.

For these mono-band monopole L–Ps, the #2 or ¼λ "active" radiator is approximately ¼λ from the balun feed point. This ¼λ line provides a matching stub between the low impedance feed point of the #2 element and high impedance at the feed point which is probably in the order of 200-300Ω, making a good match to the input of the 4:1 balun.

Summary

I believe anyone having observed the gain of the L–Ps used here will agree as to their effectiveness. When using the 17 element 20-15-10m West beam, (L–P #11) on 20m, W6's often report "strongest W4 on the band at this time." Considering that many of the other W4's are using the legal limit with rotary beams, a report of this type is encouraging.

I wish to thank the many hams who have assisted by reporting the readings taken on the various L–Ps tested here over the past four years and hope these tests will be beneficial to others. I especially wish to thank YV5DLT for his many reports on the 20m and 15m L–Ps; also, W4QS and K4FBU for their observations during the 40m tests for the past year.

I would appreciate hearing from any others trying these beams. . . .**W4AEO**

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73 Magazine Staff

Multiband Antennas - How not to be trapped

The harmonic relationship of the high-frequency amateur bands has over the years generated a multitude of multi-band dipole designs. That is, a dipole form which can be fed with a single feedline (preferably coax) and operated on several or preferably all bands 80–10 meters without any tuning adjustments. "Trap" type dipoles have been most popular over the past several years and any number of variations of trap antenna designs are available. In general, trap type dipoles when constructed of high quality components give a good account of themselves. Their disadvantages are usually fairly sharp resonance within each band so that it is difficult or impossible to obtain optimum performance in both the CW and phone portion of each band and the physical loading of the antenna structure due to the trap components. A number of amateurs have been trying to get away from the use of traps by finding the right combination of dipole elements lengths so one can construct an efficient multiband antenna from solely wire elements. The following is a description of some of these designs which have proved popular and interesting. One can duplicate these antennas directly, if desired, but they also provide some very useful ideas for individual experimentation with antenna designs.

G5RV Multibander

The antenna design of Fig. 1 is often called the G5RV antenna. By a proper combination of choice for the antenna's flat-top elements lengths as well as for the length of the 300Ω feedline, resonance can be achieved on all of the amateur bands from 80 to 10 meters. The impedance present at the end of the 300Ω line is about 50–60Ω and a regular coaxial cable of any desired length can be used after this point. Although not absolutely necessary, it would be a good idea to use a 1:1 balun for connection between the coax and the 300Ω line (note again that a 1:1 balun should be used and not a 1:4 balun). The antenna is slightly "short" on 80 meters and the 300Ω line section serves as a form of matching stub on this band and a combination of stub and/or impedance transformer on the other bands. An SWR maximum of 2:1 can be achieved across most bands with a minimum of about 1.3:1 at the best frequency within a band. One should take a bit of time to properly trim the 300 line section for the best SWR, particularly on the 20 and 15

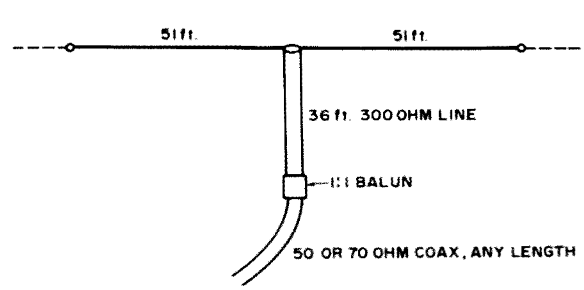


Fig. 1. The G5RV multiband 80–10 meter antenna.

meter bands. A few feet, plus or minus, depending upon the installation environment, can make a considerable difference in the SWR on 20 and 15 meters. Generally, as far as the cost of construction goes as related to performance, the G5RV design is about the best design one can find.

DJ4BQ Double-Dipole

An only slightly more complicated design is the DJ4BQ multi-band double-dipole as shown in Fig. 2. This antenna operates on every band from 80 through 10 meters. One dipole (the longer one) operates on 80, 20 and 15 meters while the other dipole (the shorter one) operates on 40 and 10 meters. So, on every band only one dipole at a time is operative and, in fact, if one were only interested in the bands on which the individual dipoles operate, one could put up just a single dipole. The theory behind the operation of the antenna is to choose the dipole element lengths just to be slightly short on each band such that about a 200Ω feed point impedance results on each band. This is accomplished by the dimensions shown for the dipole. If the feedpoint impedance is matched correctly, an SWR of no greater than 1.5 to 1 should be achieved over most of each amateur band. The dipole which is operative on each band can, of course, be fine trimmed for almost a perfect 1:1 SWR in any specific portion of a band. The matching of the 200Ω feed point impedance can be done easily with a 1:4 toroid balun working from a 50Ω coaxial line. The 1:4 balun can be connected directly at the feed point of the antenna and coax used to the transmitter or 200Ω open wire line constructed for a light-weight and more economical approach and used as a feedline with a 1:4 balun at the transmitter. The developer of the antenna recommends spacing the dipole wires at least 6 in. apart to prevent interaction of the elements. One could probably construct the flat-top from 300Ω twinlead with each wire in the twinlead forming one of the dipole elements. Heavy duty twinlead with copperweld wires should be used (Belden 8230) and one will have to do some experimenting with the elements lengths because of the close spacing of the dipole elements.

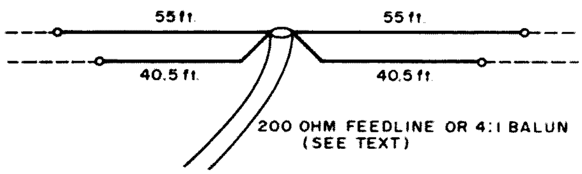


Fig. 2. The DJ4BQ double dipole for 80–10 meters.

A Modern Windom

Some old timers may still remember the classical Windom antenna shown in Fig. 3 and named after the amateur who developed it in the 1930's. It is simply a half wave antenna feed 14% off of the center point with a single wire feeder of any length. It operates only on the evenly harmonically related bands (80, 40, 20 and 10 meters for the basic 80 meter antenna; 40, 20 and 10 for a 40 meter flat-top, etc.). It enjoyed great popularity in its day as a simple but very efficient multi-band antenna and a theoretical analysis of its construction proved the soundness of its design. That is, if one studies the current and voltage relationships which exist along the flat-top on each band, the feed point chosen 14% off center does indeed provide the correct matching point on even bands for a single wire feeder. [The characteristic impedance is 500Ω at the feedpoint – Ed.] The era of TVI pretty well killed the Windom because of the rf that the feedline brought into the shack which in turn made efficient transmitter shielding and filtering almost impossible. For a short while in the mid-1950's a variation of the Windom became popular where the flat-top portion of the antenna was broken and fed by a 300Ω line at approximately the same point as the original single linefeed was connected in the original Windom. The 300Ω line could be any desired length but at some point a 4:1 balun had to be used to bring the feedline impedance down to 75Ω for a coaxial cable feed. The requirement for

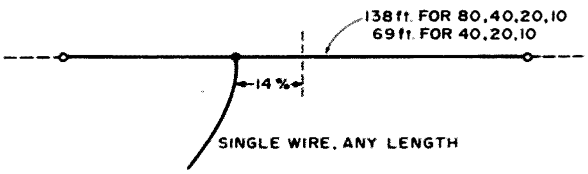


Fig. 3. The Windom antenna of the 1930's.

this multiband balun which was not a simple thing to construct before the event of toroids caused the antenna to fall into oblivion.

Recently, DJ2XH has come up with a modification of the preceeding antenna idea. Instead of using 300Ω twinlead, however, he goes directly from a coaxial cable through a 1:6 balun transformer connected in the antenna flat-top as shown in Fig. 4. A 1:6 balun can be wired using one of the toroid balun kits in much the same manner as the common 1:1 or 1:4 baluns. The balun serves the purpose of impedance stepup from the coaxial line as well as the unbalanced coax to balanced antenna transformation. An SWR of under 2 to 1 can be easily achieved with this antenna over the entire amateur

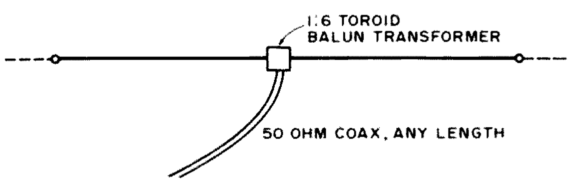


Fig. 4. The modernized Windom. Same dimensions apply as shown in Fig. 3. Balun is made using toroid kit.

bands on which it operates. Note, however, that this method of feeding the antenna does not change the basic nature of the antenna. It will operate only on even harmonic bands and 15 meters is not covered by a basic 80 or 40 meter antenna. One simple way to include 15 meters would be to erect parallel to the Windom a regular half wave 15 meter dipole which is connected in parallel to the coaxial feedline on the low impedance side of the balun transformer.

Performance and Construction

The trapless types of antennas described here once properly adjusted and checked for SWR will generally perform as well on the low frequency bands as a trap antenna and usually better than a trap antenna on the 20, 15 and 10 meter bands. The latter effect is due to the fact that on the higher frequency bands, the full antenna is still used while in the trap antennas, the traps are arranged so that the antenna remains a half-wave dipole on each band. Trapless antennas on 20, 15 and 10 start to exhibit some gain and hence directivity.

Naturally, the performance of any antenna depends upon its height above ground. However, height above ground also effects the impedance developed at the terminals of an antenna and this is true for trap or trapless antennas. Since the electrical height above ground changes as the antenna is used on different bands, the feed point impedance is also changing on various bands. A bit of patience is required to carefully check the SWR on each band before rushing to put the antenna into operation. Some time spent in trimming the flat-top element lengths, or the feedline in case of the G5RV antenna, will pay dividends over the long run with far better SWR performance on each band.

Many amateurs will undoutedly think of using these multi-band antennas as V types from a tower support. Basically, the antennas should work fine in this manner as long as the SWR is properly controlled. The Windom antenna has also been reportedly used with the shorter leg vertical and the longer leg arranged at a right angle to it.

. . .Staff

Introducing CARF

The Canadian Amateur Radio Federation, Inc.
Box 356, Kingston, Ont.
Canada K71 4W2

A New National Amateur Radio Society For Canada

The 13,500 amateurs in the largest country in the western hemisphere now have a healthy and active national organization of their own. Started in the centennial year of Canada's nationhood, 1967, the Canadian Amateur Federation now serves the growing ranks of Canadian amateurs.

In 1967 the Amateur Radio League of Alberta invited the other provincial societies to meet at the Winnipeg hamfest to discuss the organization of a Canadian national amateur society. Although for various reasons a number of provincial societies could not or did not attend, there was still interest and support for the idea from a number of them, and officials of the ARRL's Canadian Division lent their experience and advice.

The need for an independent national body for the amateurs of Canada having been recognized, a decision was taken to form as association of provincial societies under the name of the Canadian Amateur Radio Federation.

Although during the next two years several other provincial societies gained membership in the Federation, progress was slow. The membership, however, eventually increased to nine of the ten provincial societies, activity increased and finances were put on a solid footing.

Since then the national Federation has steadily forged ahead. In 1972 it was incorporated under a Federal Charter with the stated objective of becoming the national voice of amateur radio in Canada.

Each member society pays annual dues based on its own membership and appoints a delegate to the annual meeting where the Federation's officers and directors are elected. Affiliate membership is available to other amateur radio societies which are national or international in scope. Associate membership is available to amateurs who wish to support the Federation directly.

The main function of the Federation is to represent the membership on the national level to the federal regulatory agency, the Department of Communications, known to Canadian amateurs as "the DOC".

In representing the amateurs of Canada many submissions and proposals concerning regulations have been made to the DOC, after due consultation with the provincial societies. Minor problems are quickly and satisfactorily solved due to the excellent day-to-day personal contact of the Federation's officials with the department's headquarters in Ottawa, the nation's capital.

There are seven directors on the board, elected by the provincial delegates. The usual corporate officers and the heads of the various committees deal with the management of day-to-day affairs. To keep Canadian amateurs informed of what goes on in Canada in the amateur world, especially in regulatory matters, the Federation publishes "The Canadian Amateur".

This monthly tabloid, with its topical news and comment on amateur radio events on the provincial, national and international scene, has met with approval by the fraternity and has filled a long felt need which publications from other countries could not fulfill. Essentially news oriented, rather than technical, it was started orginally by an experienced newspaper man, Gil Stevens VE3BBQ, who died in 1973. The appear-

ance, format and content of the two-year-old publication is steadily improving under the hand of a professional journalist, Steve Campbell, in Trenton, Ontario.

Another Federation publication which is uniquely Canadian and is now in its third printing is "The Canadian Amateur Radio Regulations Handbook". This has been edited by a former DOC official, Art Stark VE3ZS, who heads the Federation Regulations Committee. It gives Canadian amateurs interpretations of the regulations and all the information needed to operate stations in accordance with the rules. These do not yet exist in Canada in the nearly codified form which the U.S. amateur finds in the FCC Part 97, but the Federation, at the request of the DOC, is now drafting a codified form of regulations for Canadian amateurs.

At present, the rules for amateurs are scattered throughout the Radio Act and the Part 1 and Part 2 of the related regulations. After inputs from Federation members as to changes which should be made, the draft "code" will be submitted to the DOC. If the DOC approves, the draft will go through a process similar to the FCC notices of proposed rule making. The codified regulations will be published in the "Canada Gazette" and comments invited from all interested parties.

To meet the demand for the rapid supply of information on important developments, the national Federation started the CARF News Service in early 1973. This supplies news of immediate interest directly to the editors of provincial and major club bulletins across Canada. Really "hot" items are immediately put on all major nets and broadcast from VE3VCA, "the Voice of the Canadian Amateur". Formation of a Trans-Canada RTTY net is now under way to ensure rapid distribution of important bulletins.

At the request of foreign national societies, a central clearing house for incoming QSL cards was formed in early 1973. The CARF National QSL Bureau, utilizing the Toronto-based Wheel Chair Round-up Amateurs under the capable leadership of Len Sumner VE3DOR, now handles thousands of cards, speeding their despatch to the provincial bureaus and in some cases directly to the amateurs of Canada. The Bureau provides an interesting work outlet for a number of handicapped persons.

The regulations for the Canadian Amateur Experimental Services differ in many ways from those of the United States. Two classes of life time Certificates of Proficiency in Radio can be obtained – amateur and advanced amateur. The first enables the holder to license an amateur station restricted to CW operation on the HF bands with phone etc., privileges above 30 MHz; the latter gives full operating privileges on all amateur frequencies. Both classes may obtain a station license which includes their mobile, portable and base stations. In addition to the theory requirements the amateur certificate requires 10 wpm and the advanced "ticket" requires 15 wpm.

Special suffixes to the normal VE– and VO calls can be readily obtained for use by clubs, organizations, auto repeaters, etc. For example the prefix "C" in combination with certain other letters is often used for such calls in Canada.

Last year the Federation proposed the formation of the Canadian Repeater Advisory Group (CRAG) jointly sponsored by it and the ARRL Canadian Division. A national two meter channel plan, compatible with the ARRL plan, was recommended and the formation of repeater councils in all areas has been encouraged. The support of CRAG is reflected in the fact that most amateur repeaters are now using the recommended channels and 600 kHz spacing. The objective of the Canadian channel plan is to enable a mobile station to travel from coast to coast in Canada using a minimum number of crystals. So far the plan has five channels, with three or four more being recommended for congested areas.

As much of Canadian VHF mobile activity is close to the U.S. Border a number of the repeater councils are international and are working efficiently in channel allocations and preserving good relations that have always existed between the Canadian and U.S. amateurs. CRAG bulletins to provincial councils and FM associations provide a clearing house for repeater information on frequencies and DOC rulings. There are no repeater regulations in Canada but rather a minimum of "guidelines" which are easily

met by owners or operators. This follows the DOC policy of minimum regulation and letting the amateurs do their own policing.

Canadian amateurs are well aware of the contributions made by the ARRL in Canada since the League assumed a trusteeship of amateur affairs in Canada in 1923 at the request of a delegation of Canadian amateurs. This trusteeship developed into the formation of a Canadian division of the League with the full, voting status of any ARRL division. There are unique advantages in having a Canadian amateur on the ARRL Board, not the least of which is the facility to put the position of the Canadian members of the League before the ARRL Board.

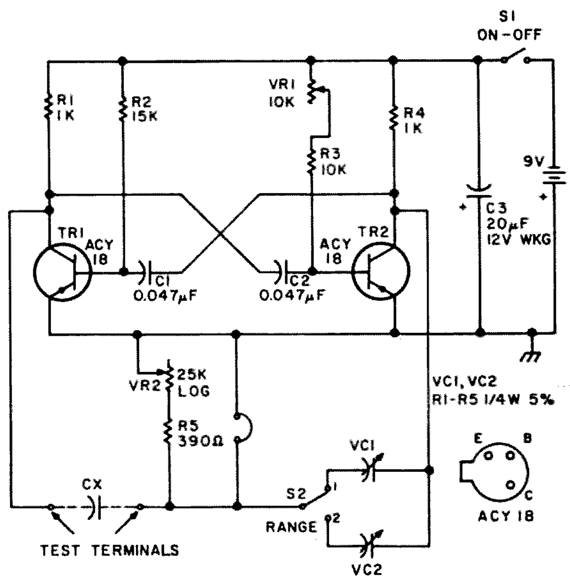
Two Canadian division directors have been elevated to the post of vice-president ARRL over the years, the last being Noel Eaton VE3CJ, who recently assumed the office of president of the International Amateur Radio Union.

At present the ARRL Canadian division director sits on the IARU for League members in Canada but the Federation has requested that this representation by relinquished to it as the federally chartered national organization, as befits a sovereign nation. There is growing support for this action in Canada but the IARU has to date not recognized the Federation's legitimate aspirations in this direction although the national Federation is ready and willing to undertake this responsibility.

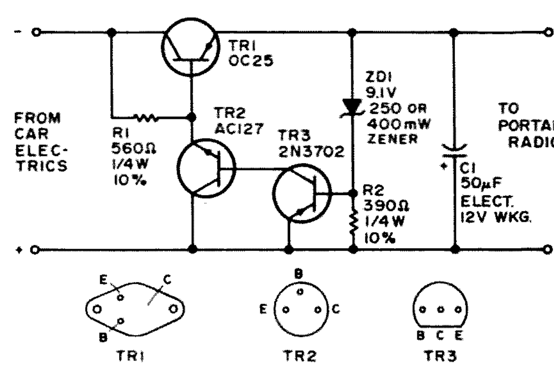
On the domestic scene the Federation is studying a probable change to full voting membership by individual amateurs as well as by provincial societies, enlarging its administrative and organizational structure and an increasing its now sound financial base. Its future lies with the amateurs of Canada. Their participation and support are needed.

For interested amateurs, the mailing address for information about the Canadian Amateur Federation Inc. is P.O. Box 356, Kingston, Ontario K7L 4W2. Annual dues for individual associate members are $5.00 which includes a subscription to the Canadian Amateur. A new and up to date Canadian Regulations Handbook, just published in its 2nd edition, is now available for $4.00 from the same address.. ... VE3VCA

CIRCUITS...



Precision rectifier for ac Volts to 1V for your lab. Used with an attenuator you have a precision millivoltmeter. To set up short A and B to ground and adjust P2 for zero output. Unshort A and B and adjust P1 for zero output. Complete details can be found in Radio & Electronics Constructor, Aug. 74 page 25.



9 volt supply from 12V battery. Project from Aug. 74 Radio & Electronics Constructor, 57 Maiden Vale, London W91SN, England. Sub: $7/yr.

W2NSD/1 from page 3

tacted us on BGI had as much fun as those of us who made the trip – that is something none of us will ever forget for the rest of our lives – it was true adventure.

Armond tells a story of an aircraft in trouble whose MAYDAY call on 20m was answered by two W6s with a request to QSY since they were busy working Europe long path. True story. From this Armond decided that the W6s didn't care whether the plane crew died or not and again the finger of guilt was pointed. Baloney! Five will get you ten that the 6s heard someone opening up in the next channel and asked them to move. I'll bet that as soon as they found out it was an emergency they broke their guts to do everything possible to help. Hams don't ignore cries for help – if anything they over-react and go to incredible lengths to help. They get medicine for people in remote places against all sorts of odds. They get word of illness through to relatives. And they do this regularly.

Amateur ingenuity quickly overcame the benefits of the VOX circuit . . .

Sure, we have a few nuts among us. The FCC has not yet started giving sanity tests along with the code test – or even intelligence tests. Not that intelligence counts for much, by the way. The head of Mensa recently observed that "intelligence is no impediment to stupidity." I think that is worth making into a plaque or a bumper sticker. The 6s in question did something stupid.

While it probably isn't fair to pick on Armond for saying these things, since many others have said them before, the fact that a publisher and editor of a ham newspaper sees hams in this way is significant – and it is indicative that a great many other amateurs may be thinking of ham radio in the same terms. Should we feel guilty because we don't "build any more?" Should we feel guilty because we don't feel that we personally are really contributing? I think we should all feel proud that we are a part of a group that has contributed so much.

The fact is that few of us are perfect creatures. There is more than a little bit of laziness in the best of us – some larceny – prejudices – arrogance – and all of the other characteristics that we really wish we didn't have, but are stuck with. Sure, darned few of us can look Armond in the eye and tell him that, dammit, we have nothing to feel guilty about. Not honestly, anyway.

There is no requirement in this world for anyone to be perfect. It is not expected and I think if someone perfect were to show up we would get rid of him as fast as we could. We have a pretty good record along that line, right? People who are too good step on toes and have to be taken care of.

Once we understand that we really don't have to be perfect – to try and be Super-ham – we can start coming to terms with our hobby. It is difficult to work when you are all wound up with guilt – it's a big turnoff. Just ask club presidents and club bulletin editors who try to use guilt to get members to meetings or to write for the club paper – it doesn't work. Guilt has been used for years to try and get us to use our unused bands. No amount of shame will populate 220 MHz – we'll see activity there when there is a good logical reason for using the band – when it is *fun.*

The FCC regulations give us a list of the reasons for amateur radio to exist in this country. It is worth reading over. It starts out with our providing communications in times of emergency. We do that. Few of us have not participated in some sort of emergency communications and every one of us is ready and trained to be of help when the time is right. Fate may not have selected *you* quite yet, but it probably will.

The regs ask that amateurs contribute to the radio art. We do that. We may do it by working on some fool invention that can't possibly pan out . . . but does . . . something no laboratory could waste time and money on. We may do it by helping another ham prove a new system or technique is workable as thousands of amateurs did when FM was first invented – when narrow band FM was pioneered – when sideband was pioneered – when SSTV was pioneered – when new RTTY circuits were developed and tested on the bands – etc. Did you know that circular antenna polarization (which is now used for much of the satellite work) was invented by a ham and pioneered on the ham bands? . . . that the parametric amplifier was developed on six meters by a ham? . . , etc.

Is there any reason for self-flaggellation if we are guilty of not personally inventing SSB? . . .

The regs ask us to become skilled in communicating and in technical work. Contests and certificates encourage us in learning communications . . . building helps us develop our technical abilities. More hams are building today then ever before in the history of the hobby, as you probably know. True, not many of us build stuff that we can buy – it isn't very practical to build a receiver or transceiver today – but that doesn't stop us from knocking together counters, synthesizers, and all of the other goodies described in the articles in 73 Magazine. One look at the pages of ads for parts tells the real story about hams building – I count 39 pages of parts and test gear advertised in the January issue of 73 – just compare that with any past year of QST back during the golden age of building in the 20's and 30's.

Obviously no one can do everything – at least not until there is a certificate out for it . . .

The regs ask that we have a reservoir of trained operators, technicians and technical experts. That includes every one of us one way or another. There is nothing there about any of us having to be all three – to be super-ham.

Lastly, the FCC mentions international good will. Even the most dedicated DXer does get into long winded contacts with fellows in other countries now and then when things are slow . . . and many contribute to international good will. Oh, a few work up some pretty bad will, but not many.

Hopefully I have done much to expiate any latent guilt feelings you may have had about amateur radio. With that out of the way, let's take another look at our hobby and see what we can do to improve it. I hope that we agree that hamming is fun. No matter what your present bag is, I hope you'll agree that all aspects of the hobby are fun for those involved. Building is fun – DXing is fun – contests are fun – moonbounce is fun – Oscar is fun – inventing is fun – repeaters are fun – rag chewing is fun – clubs are fun – club newsletters are fun – traffic handling is fun – phone patching is fun – and so on. The other side of that coin is the understanding that no one aspect of amateur radio shines golden with good as compared to the others. There isn't time for anyone to do everything in amateur

Continued on page 138

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radio – and there is thus no logical reason for any feelings of guilt over omitting some of these aspects of the hobby – and there is no reason to be bigoted about your particular current enthusiasm and talk down other interests.

The FCC has not yet started giving sanity tests along with the code test . . .

One of the purposes of 73 Magazine is to try to communicate the fun of the different aspects of the hobby. We try to encourage you to try new things – to learn more about what is going on. When two meter FM came along we saw it as big fun so we did everything we could to get you to try it. At first it was a lonely go, with readers writing in telling us not to bother them with all this FM stuff, and with little help from the other ham magazines. But gradually, after a couple of years, after about 20,000 of the 73 readers had been convinced to give FM a try, and the couple of hundred repeaters had grown to a thousand, the other magazines discovered FM and then it was okay.

DOCKET 20282

The basic reason cited for the "restructuring" of amateur radio is the steady drop in the number of amateurs. Frankly, I don't think that setting up a Communicator Class of ticket is the only possible solution to the problem . . . but it may indeed work.

Even if this does go through, which I suspect it will, perhaps it is time for us to sit back and think a bit about amateur radio and our personal involvement with it. We don't have to wait for 20282 to go through and unleash a million CBers on our VHF bands (well, some people are predicting that . . . I don't believe it), we can get started right away with programs to get more hams licensed.

A few hams have discovered that it is fun to teach people to get their tickets. Bill Welsh W6DDB has helped over 20,000 to get licenses so far and is still at it hot and heavy. He is doing that because he enjoys it, not because he is a saint or a super-ham. Bill's classes take up so much of his time that he doesn't get much else done in hamming – a fact that I hope does not make him feel guilty.

Code classes are simple to set up – all you need today is a cassette player and you are in business. Theory classes aren't much more difficult. If you aren't sure about the thoery then ask around and you'll find volunteers who do know what they are talking about and who will help. High schools are brimming with prospective hams – as are the CB channels – not to mention the retired people and the handicapped in your neighborhood. Deaf people find amateur radio a fantastic blessing – they use CW and RTTY – as do the blind. I've even met deaf-blind hams. And you think *you* have problems!

How do you get people to the classes? Advertise. You use the local bulletin boards – demonstrations in shopping plazas – signs at the high schools – articles in the local papers on ham activities and the benefits of amateur radio – there are any number of ways to attract newcomers.

Be proud that you are an amateur – a ham – a HAM! Let your neighborhood know what it means to be a ham and how much fun it is. Let them know what the benefits are to them – how older people and shut-ins are no longer lonely – how you provide telephone calls home for service men

If you have some TVI, look upon this as an opportunity to convert a neighbor to an appreciator of amateur radio, not as a curse thrown on your door . . .

in isolated parts of the world – how your help in times of disaster – how you make friends all over the world. If you have some TVI, look upon this as an opportunity to convert a neighbor to an appreciator of amateur radio, not as a curse thrown on your door. Get in a couple of other hams and invite the neighbor over to see and talk – and air his complaints – be sympathetic and work with him to solve the problem. You may end up, as many have, with TVI of your own when the neighbor gets on the air.

Hams often wish that they had political clout. It isn't that difficult to get, with just a little planning and work. A club can arrange things so their Senator or Representative gets a good view of amateur radio in his home area. All of these gentlemen do get back home now and then to campaign and they are very interested in meeting constituents. If your club arranges a meeting at the shack of a member the chances are that the congressman will come. You'll be able to tell him about amateur radio and show it in action to him, complete with an interesting (and perhaps preplanned) DX contact. How many CBers do you think will be able to pull something like that off? And you know that such a demo, besides being invaluable to the hobby, would be a lot of fun.

It really is about time for all of us to feel a tremendous sense of pride in our hobby. It is one of the most valuable hobbies there is. Youngsters that we get involved in it will probably benefit from the association for the rest of their lives. A high percentage of high school age hams go into electronics or communications for their life's work – providing both our country and the world with the technicians and engineers to keep things developing.

When an amateur provides emergency communications we should all be proud to be a part of this – that one of our brothers was lucky enough to be in the right place at the right time.

Sure, there is a lot we can do to improve the image of amateur radio. We can pitch in to help when there are services to be performed for our communities. We can keep our imaginations active for ways to use amateur radio for public service – and we should do all we can to make sure that our services do not go unnoticed – for these things are news and will help us attract more prospective amateurs.

And the next time someone gets up and starts making you feel guilty about your lack of participation in amateur radio – don't let him get away with it. Stand up and give him hell.

DX INFO WANTED

Readers in foreign countries or amateurs visiting other countries are asked to get all the information they can about the classes of licenses available – the privileges of each class – and some idea of the exams involved in getting the various classes of license, including a brief of the exam material if available. Please send this information to 73 Magazine, Peterborough NH 03458.

This info is needed to help with a booklet on the subject – it may also be of considerable help to the FCC in its reciprocal licensing program and to the amateur licensing authorities of countries planning changes in licenses. It could be most helpful too in approaching third world countries – the countries which now hold the whip hand at the ITU.

. . . W2NSD/1

Wayne Green W2NSD/1
c/o 73 Magazine
Peterborough NH 03458

Mobile Slow Scan Television ?
. . . yes - and other trivia

Not a few of the slow scanners are working their countries mobile these days. Well, if they can work 'em on the low bands, why not two meters too? No reason against it, obviously.

The next step was to give it a try with a small cassette portable recorder. This was put up to the 2m FM mike and the system worked, amazingly enough. That slow scan is rugged stuff when it will manage to survive a trip through a cheap recorder – out a tiny speaker, into a ultra-low fidelity hand mike, on through a 2m rig, then a repeater, another 2m receiver and finally into a slow scan monitor. Formidable.

The fact emerged from the tests that it is difficult to drive evasively enough to ward off wild Massachusetts drivers while running a tape recorder on the passenger seat and holding the mike to its speaker. The quick change on receive to the recorder mike into the 2m speaker so the received slow scan signals could be recorded and looked at later on the home monitor was too much. Obviously a more permanent installation would have to be made.

Toshiba had a good looking mobile cassette recorder – stereo – so that was bought and installed behind the passenger seat. There is a little problem in the Datsun 240Z car that not everyone faces – a drastic lack of room for installing more than one or two of those small boxes our rigs and other toys come in. I'd already used up the most choice spot for the IC-230, which was screwed to the drive shaft tunnel at my right knee, facing up at me. Just forward of that was the Heath Siren/P.A. system. And there was no room at all under the dash, so the only spot I could easily reach was behind the passenger seat, screwed to the tunnel wall. This turned out to be just fine and simple to use.

Any stereo system is no better than the loudspeakers used – and, in general, this means the larger the speaker and speaker enclosure, the better the sound. That is, of

course, an oversimplification, but not far off base for smaller speakers. In the interest of economy and the best sound I could manage to fit in the car, I decided to get a pair of the Heath bookshelf "hi-fi" speakers.

The pair of Heath AS-16's went together easily and didn't take up too much room in the back of the car. The sound may not be hi-fi, but it is spectacular compared to just about any other mobile stereo system.

Having been a designer and manufacturer of speaker enclosures in past years, I have a fair idea of what can or cannot be done within the confines of an automobile – and I must say that the sound coming from the Heath speakers was not disappointing. Though small, the speakers filled the inside of the car with a surprisingly rich bass. I made cassettes of some of my more demanding demonstration records and found that the performance was quite credible. Perhaps some day I'll have the time to put together an enclosure of my own design to match one of those super compliant four inch speakers. I'll bet that I can get the response down to below 40 cycles with that – and that's all you can really expect in a car.

The interwiring took a while – connecting one output of the cassette recorder to the IC-230 for slow scan transmission – the output of the 230 to the recorder – as well as to the public address system and a separate speaker which is in place of the car's ash tray (I don't smoke) and cigarette lighter on top of the transmission hump. I installed a small switch in the moulded plastic hump cover to switch the speakers from the cassette recorder to the stereo car radio, and another switch to permit the Heath P.A. system to be fed from the stereo line or the IC-230 audio. That's enough switches to keep anyone happy.

To send slow scan it is only necessary to plug in the SSTV cassette. To receive, just turn on the cassette recorder.

Stereo FM signals take a lot more rf signal strength than mono, so I found that I was having trouble with many of the signals fading as I drove around through the mountains and hills of New Hampshire trying to listen to those Boston stations about seventy miles away. I needed more antenna. I checked the Lafayette and Radio Shack catalogs, but could find nothing listed that looked like a gain antenna for 100MHz mobile. One day, while talking with Andy at Gam, I mentioned this problem and within minutes I had a nice Gam gain antenna in hand for the broadcast FM band! Durn thing worked, too. I could even get good stereo copy from inside my garage, right through the local mountain which shields us from all those nice Boston stations on FM and TV. If you need a little more poop in your car stereo receiver you could do worse than check into the Gam SS-FM gain antenna.

The IC-230 has a plug on the side to feed in audio such as the output of a tape recorder. The Standard, which I used previously, had one on the back panel for the same thing. Many of the FM rigs are set up for that – not that it is so difficult to match into the mike circuit if your rig doesn't have that facility.

Even though you might not be all that interested in going slow scan mobile, you still might like to have the ability to make tapes from your 2m FM rig – or from the car radio. Now and then there is either something so interesting or so awful on 2m that I am glad I have the recorder set up for quick use in the car. I get some fantastic recordings now and then when I'm passing through Connecticut on the way to New York. One of the ARRL HQ chaps is on 2m down there and he has fascinating things to say about me.. .on the air!

Not that there is anything to stop you from getting on the low bands with slow scan mobile and joining the country hunt on 20m – several fellows are doing it and having a ball. It may be telling tales out of school, but the fact is that it is perfectly possible to work hundreds of slow scan ops without even having a monitor of your own, much less a camera. You do need a friend with one so you can play your tapes and see your contacts – and make up your own transmission tapes.

All of my slow scan two way contacts from Jordan (other than when I was operating JY1) were done completely via a little Toshiba KT-270 hand held tape recorder. The two way slow scan contacts from Navassa at KC4DX in 1972 were all done with an under $20 cassette recorder! In both

cases I had to wait until I got back to New Hampshire to see the pictures I received.

Before you rush out to buy an El Cheapo cassette recorder, perhaps I should explain that while these will send and receive usable pictures, the fact is that there are a lot of jiggles in them which wouldn't be there with a better recorder. Many of the SSTV crew use fairly good quality reel to reel recorders and you can tell it when you see their pictures – they're clean and sharp. Some of the newer cassette decks will do the same job, but they all run well over $100, with many in the $300 and up range.

Right now we're having superb results with a Toshiba PT-490 – that's the new Dolby deck which has automatic reverse built in – and I see it listed in the latest Radio Shack flier with their brand name on it for $320, with the only difference noticeable being circular pots instead of sliding pots and an "edit" button. . .called the Realistic SCT-7. We're also using it for making the Morse Code tapes.

Another good deck we've been using lately is the Concord Mark IX, which has the advantage of a built in mixer for microphone and separate line input. This was used for making the Novice tapes and the Morse Code tapes which have voice and code mixed.

There are so many applications for a good Dolby cassette deck that it is one of those things that you turn out to use just about every day once you have one – much like a frequency counter. I went for years without a counter – I dunno how – and now that we have one handy, it gets used just about daily. It may be for crystalling up an HT for a visit to a hamfest or to Boston – testing the stability of a vfo – checking out a receiver calibration or a calibrator – finding out which FM transceiver a crystal was made for (each crystal is easily identifiable by how much higher or lower than the marked channel it is – for instance the crystals for the Wilson HT and the Henry FMH units are 17 kHz lower than marked on the average – Standard receive crystals run about 12 kHz high – ICOM receive run 66 kHz low – when used in a broad band oscillator).

The cassette decks are great for taping talks at clubs – making up talks for clubs where it is too far for me to travel – duplicating music from the radio – things like that. Along that line, if any readers have a chance to tape any League officials who are making speeches or FCC officials doing ditto, I would appreciate getting a chance to run off a copy – I'll get your tape back to you pronto. The Toshiba KT-270 does a nice job of picking up a speaker at a considerable distance, but it does sound better if you can get the recorder or at least the mike up there within a foot or two of the speaker. Few speakers have any objection.

We're in the process of getting a couple of new cassette recorders for this type of application, a Sony TC-55 for low profile

recording and a Sony TC-152SD for really top notch work where hi-fi will be helpful. I'll let you know more about these after we have a chance to use them a bit. I am sure that both will be superb for slow scan.

There are several types of tape available to confuse the newcomer to cassettes. You can use just about any at all for slow scan and they will work, but if you are going to the expense and trouble of making your slow scan tapes with a good recorder, it makes sense to use a fairly good tape. High fidelity addicts will probably go for the most esoteric tapes, such as the chromium dioxide, but this added expense (and they are not cheap) is a waste for slow scan. Since most of your slow scan programs will be relatively short (hopefully), you won't be getting into the thinner tapes that are used for the 90 minute cassettes or the ultra-thin tapes in the 120 minute cassettes. Don't ask for trouble. Any of the 60 minute or shorter cassettes use the thicker tape, and that will last a lot longer with rough handling and use in inexpensive recorders.

... W2NSD/1

Craig Anderton
P.O. Box 172
Monte Rio CA 95462

Yet Another Etching Technique

Something fishy here.

Let's face it, etching pc boards is not exactly the best part of working in electronics. This method, however, does seem to give a minimum of hassles and a cleanly etched board.

The key to successful etching is agitation. Usually this is accomplished by putting the pc board in a shallow, photography-type plastic tray, and rocking it back and forth until the board is etched. This is fine until you get tired of rocking it back and forth, at which point some mechanical rocking system is usually improvised.

A simpler way to agitate is to purchase a small aquarium aerator, available at under $10 at pet supply houses. They work by pumping air through a plastic tube, which then ends in an aerating stone; the stone is highly porous, and converts the steady stream of air into lots of little bubbles (see Fig. 1). These little bubbles not only aerate the ferric chloride, keeping it fresher longer, but also scrub the copper-clad pc board surface in a gentle yet effective way. The constant agitation also etches the board very evenly.

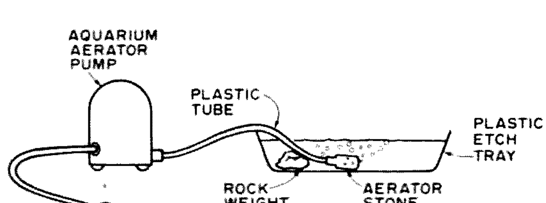

Fig. 1.

One thing you'll notice is that the force of the air will tend to make the stone bob up to the surface of the ferric, where it does no good. Chances are you'll have to weight the stone down; try a rubber band around the plastic hose, connected to a rock so the whole thing will stay put in the bottom of the tray.

You can simply put the aerator in your etching tray; but if you etch a lot of boards, you might try the following. After you've used up the ferric in the etching tray, don't throw it away but rather buy a small plastic garbage can and pour the spent ferric in. Anytime you have some excess or old ferric, throw it in the garbage can.

Now that you've got a can full of ferric, place a dowel, rod, coathanger, etc. across the top, hang the printed circuit boards by some nylon thread or equivalent, and put the aerator stone in the bottom of the can (Fig. 2). The bubbles will come up through

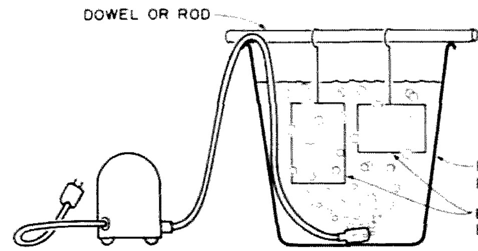

Fig. 2.

the pc boards and etch them just fine.

One final tip: after the ferric chloride appears totally gone, you can extend the life even further by throwing in a little bleach. However, stand back when you add it – no explosions or anything, but the smell can be pretty potent. For some reason this seems to re-activate the ferric a bit and extend its useful life.

So there you have it, another way to etch boards. The principal advantage is that you can do a fair amount of boards with a minimum investment in ferric chloride, and you get to recycle old ferric by throwing it in the garbage can, aerating it, and extending its life. Check it out. ... ANDERTON

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#175 APRIL 1975

COVER: Photo of Judi Light, AKA Judi Repeater, courtesy of Charles Webb KØBWR.

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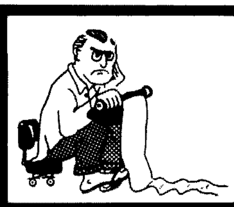


NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

I think it is about time we stopped insisting on exams and spent a little more time trying to interest amateurs in learning about new things because they are fun.

Docket 20282 is just another attempt by the FCC to get incentive licensing to work. There was no legitimate excuse for proposing or putting through the incentive licensing rules and I see none for this docket either.

The whole idea of forcing amateurs to go down to the FCC and take exams to get higher classes of license serves no useful purpose. It wastes a lot of time for the amateurs who have to study the theory and code required for these tests and it wastes the license fees involved. Passing a test proves very little — it certainly doesn't make better operators — it doesn't make more hams — it doesn't develop experimenters — it just wastes time and effort.

Not one amateur in a hundred is prepared at any moment to pass an FCC exam — every one of us has to get out the books and study for a while before we are up on the material in the tests — and this is because there is no way for the tests to be consistent with real life. Passing a test is passing a test — it does little to help an amateur as an amateur.

The fact is that amateurs who are interested in CW get to be good at it. Those interested in RTTY learn about that — and no amount of questions on an exam about RTTY will aid the learning process. I think it is about time we stopped insisting on exams and spent a little more time trying to interest amateurs in learning about new things because they are fun.

A few years back we had just two classes of ham ticket — the beginner or Class B, and the Advanced or Class A. Oh, yes, there was a Conditional, Class C, for those over 75 miles from an FCC office. That was the same as the Class B. The fact was that practical experience in those days showed us rather clearly that there was little to be gained from the Class A exams and we could have done just as well with one single class of license. Many of the Class A amateurs wore their ticket as a badge of honor and were absolutely insufferable about it.

So here we are today with six classes of license and the prospect of two more being added to the list. For what? One look at the FCC regulations tells us that this whole intricate construction is absolutely against the most basic rules — the very foundations set out in 97.1 — the basis and purpose of amateur radio. Unfortunately not one amateur in a thousand has read over the rules.

So here we are about to set up a new license class — a Communicator Class. Do we have any evidence at all that a code-free ticket will accomplish anything beneficial? What is it that the FCC wants to accomplish with this new license? The language is vague, but apparently one rationalization is that this will magically bring in thousands of new amateurs. Another is that the restructuring will repair the faults in the incentive licensing regulations which have failed so miserably.

We've been publishing the FCC figures on license exams in Hotline for the last year and they show very clearly that about 80% of those who flunk the ham test drop out over the written exam, not the code. The fact is that code has been a negligible deterrent for those trying for ham licenses — so what is there to gain by getting rid of it? Not much, it would seem.

But what about Japan where a no-code ticket has resulted in over 300,000 amateurs? Surely that is proof that a no-code license will drag 'em in by the tens of thousands? Sorry, but the main reason they have so many amateurs in Japan is because the clubs are organized and give classes in amateur radio, complete with licenses for those graduating. There is no indication that the success of amateur radio in Japan has any connection with the no-code aspect. If every ham club in the U.S. had classes for beginners and the members were

out beating the bushes for newcomers, we'd have tens of thousands of new amateurs over here too.

Unfortunately, only a small fraction of our clubs have classes for newcomers and a great many clubs actively discourage youngsters from coming to meetings. If the clubs I've visited in New England are any criterion, very few clubs are making any effort to attract high school kids – and it is the 14 and 15 year olds which are our major source of new hams.

If every ham club in the U.S. had classes for beginners and the members were out beating the bushes for newcomers, we'd have tens of thousands of new amateurs over here too.

If the clubs would get out there and train new amateurs we would have no problem with dropping numbers – no need for any no-code license – no fear of CB – no worry about all those virtually empty ham bands that we know we are going to lose for lack of use – no panic over the vacant 220 MHz band – the almost inactive 10m band – the vast silences on six meters – the quiet which has descended over the bottom two MHz of the two meter band – and so forth.

Against the Rules

Let's take a close look at the rules – in particular 97.1, the basis and purpose of the regulations. Just one part of 97.1 has to do with the regulations and only the regulations – that is 97.1c and, as the only rule having to do with the purpose of the rules, it should have constitutional power for the FCC.

This section says that the rules should provide for advancing skills in both the communications and technical phases of the art. How does that square up with docket 20282? The docket is a clear miss on this and as such should be considered as unconstitutional and should be thrown out.

Taking 2/3 of the hams off of experimental modes of transmission is hardly advancing skills in the technical phases of the art.

Taking away the franchise for Techs, Conditionals and Generals to operate on ATV, SSTV, RTTY, Touchtone, Fax, and all the other innovative types of modulation is flatly against the whole concept of the rules. Remember that this affects about 2/3 of the licensed amateurs, not just a small part. Remember also that a good part of the experimentation on some of these modes has been done by the Techs. Taking 2/3 of the hams off of experimental modes of transmission is hardly advancing skills in the technical phases of the art.

No Code?

Letters coming in from happy users of the 73 code cassettes indicate that most amateurs are able to learn the code from scratch and get to where they can pass the five word per minute test in a matter of three or four hours – with one hour being par for learning the letters and numbers. Data is still coming in on the time it takes for 13 per, but apparently is is quite short using the new blitz techniques of the code cassettes – running about 10 hours of practice.

Considering the uses of the code, perhaps the advocates of no-code should rethink. Our CW bands are still quite active – most of the satellite contacts are via code – we use code for identification on RTTY and repeaters – code is used for most DXing on VHFs and moonbouncing. Code is not yet dead.

When I set up the amateur radio structure for Jordan I set it up with a five word per minute code exam – but none beyond that. I figured that those who like CW would develop their skills and that they would get far more interested in CW if it was not made a big ogre. Time has proven me right on this.

Though it might be traumatic for a lot of old timers, I'd like to see one single class of license in the U.S. I'd like to see one with a 5 wpm code test and a theory exam about like that for General. Beyond that those interested in RTTY will learn about it – those into SSTV will ditto . . . etc. Learning is fun and studying for exams is a pain in the lower back.

Let's throw out docket 20282.

We don't need classes of license to keep amateurs out of our bands – this just puts off the day when QRM forces us to invent and pioneer new techniques which will be of value to the world. We pioneered SSB and NFM, the two of today's most used communications modes, and we can pioneer new and better systems if we are permitted to experiment.

The proliferation of repeater councils and frequency coordinating committees for repeaters proves to me that we can run amateur radio ourselves without any help from the FCC

Continued on page 140

HOTLINE HEADLINES

FCC proposes automatic indentification of transmitters using ASCII code (docket 20351). It would apply to just about all services other than amateur (including CB).

Call letter change docket, companion to 20282 restructuring docket, held up by FCC staff losses.

North Carolina/Tennessee repeater feud (16/76) could seriously affect repeater regulations for whole country.

Immigrants and visitors may now take FCC ham exams as a result of a new law (93-505).

New CA3130 op amp mosfet/cmos chip detailed – also LM1808N ditto chip.

Over 5000 VHF Engineering transmitter strips sold to date – plus over 800 of the walkie-talkie kits.

CB advertised on TV in prime time to build up CB market – gets free ads as public service – so where are amateur radio ads?

Police oppose CB patrols as possible vigilante groups.

Ladder hassle on towers resolved in favor of amateurs.

Canadian Amateur Radio Federation (CARF) recognized by Canada DOC – ARRL loses another battle to keep tight control of Canada in U.S. hands.

Get a receipt! Amateurs in NY indicted for receiving stolen rigs bought at hamfests.

FCC strikes at CBers – cites 75 in Little Rock, 104 in Cleveland.

QST super blooper – virtually direct copy of old 73 article is QST feature for January and February.

Chronex watch – a computer on the wrist – invented by ham.

Amsat reports 87 countries using Oscar 6 so far – 18 WAS certificates awarded – almost 3000 contacts reported to them. Oscar 7 much better than 6 and certain to give program a big boost.

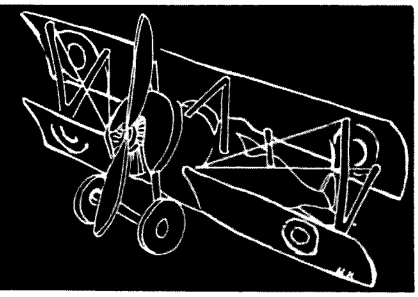
Ham movie available from PARC – the adventures and misadventures of the club during Field Day 1971.

Dealers report ham biz holding well – sales only held back by delays from manufacturers.

ITC Multi-2000 being tested at 73 HQ – considerable enthusiasm generated over this $700 CW/SSB/FM synthesized rig.

Autobiography of an Ancient Aviator

W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230



Thanks to the bootleggers, low flying on maneuvers sometimes led to high flying on Saturday nights . . .

WILD BLUE YONDER
CARLSTROM FIELD, ARCADIA, FLORIDA, 0800 15 NOVEMBER 1922.

This morning flying instruction started. Each Cadet was assigned to a flying instructor and not one failed to draw the best instructor on the field. I drew Lt. Tommy Claude. He was a tall, affable fellow who used the "follow me" method of instruction. His idea was that if a student became proficient in air work, and had a good feel of the ship, take-offs and landings would come more easily.

The planes used for primary instruction were Curtiss JN6H (Jennies) with 180 HP Wright Hispano-Suiza engines. These planes were used for training during WW1 equipped with 90 HP Curtiss OX5 engines. They had two open cockpits, front for instructor and rear for student. The Hisso Jennies were very easy to fly and had practically no bad habits. Of course, like any other airplane, if they "ran out of air" (stalled) they came right down.

While I was busy practicing wing-overs, figure 8s, rolls, loops, side slips and other air work, Lt. Claude would watch for any cars crossing the prairie. If they stopped and hid a package under a mesquite bush he would mark the spot on a map. A few times we were lucky enough to spot a bootlegger caching some of his liquor load near a place where we could land. The Claudes lived in the same apartment house we did so the next Saturday evening we would give a party, inviting guests to come and bring the food.

About the sixth or seventh morning of my instruction, Lt. Claude told me to go to the hangar supply room and get two shot guns, ammunition and hip boots. He said that the lesson this morning would be duck hunting. The prairie north of Carlstrom was dotted with small ponds that were quite shallow and surrounded by high roads. They provided excellent cover for migrating ducks. He landed near one of them but the meadow was too soft so the ship stuck its nose in the ground and the propeller went the way of all nose-over props. Claude said not to worry, that soon someone would spot the tail of our ship in the air. Sure enough it was only about 15 minutes before Lt. Hez McClelland came over low. We pulled the tail of our ship down and pointed to the broken wooden propeller. He left and was back again in about half an hour and landed on some nearby higher ground with a new propeller and installation tools. In the meantime Claude and I had each bagged a couple of ducks from the pond. It took us about 45 minutes to remove the old prop hub and install the new propeller. The Claude taxied the ship to firmer ground, I got in and we were back at Carlstrom in time for lunch. Lt. Claude got the officer's mess cookee to pluck and dress the ducks so the Claudes and Greens had wild ducks for dinner that evening.

In spite of all the extracurricular activities, Claude soloed me after about eight hours dual and hunting instruction. I must have been a trifle overconfident because at about my tenth solo landing I leveled off a bit high and ended up with my nose in the ground, tail in the air and a broken propeller. This made necessary another hour of dual time with a new instructor — Lt. Umpstead. Lt. Claude was not available as he was in the hospital as a result of a slight miscalculation of his own.

It seems that Lt. Claude had flown a DH4B (DeHaviland with Liberty engine) to Fort Myers, about 40 miles south, to pick up two majors who had cracked up there earlier in the day and bring them back to Carlstrom. His crew chief went with him. They got a late start back, the two majors squeezed into the rear cockpit, with the crew chief out on a wing straddling a strut. In those days field lighting for night landings consisted of a few lights on the hangars that dimly lit the field a short distance in front of them. By the time Claude got back to Carlstrom it was dark and he evidently didn't allow for the extra load he had aboard, for his wheels hit a drainage ditch at the edge of the field. That put the DH over on its back tossing out Claude and the two majors and killing the crew chief. Claude sustained a broken leg and numerous cuts and bruises while the two majors were only bruised and shaken.

The rest of the primary flight training was uneventful as far as accidents were concerned. I practiced landing to a mark (180s and 360s) acrobatics and other air work, formation flying, cross country trips and night flying with periodic instruction and checks to make sure I was not developing any bad flying habits.

Ground school terminated on February 18th and from then until my departure for Post Field on May 15th my only duties consisted of flying. I passed all the numerous check flights and was glad to be checked out to fly DH4Bs. I also got a small amount of time in some WW1 single seater fighter planes such as Nieuports, Spads, SE5s and Thomas-Morse Scouts. The Nieuports were different from the other planes I had flown in that they had a rotary engine (the entire engine revolved). These engines had only two speeds — on (full speed) and off. There was a coupe button on the top of the control stick that, when pressed, cut off the ignition. When you were coming in to land you had to keep giving the engine spurts of power in order to keep it from quitting altogether. Same thing when you were taxiing. My total flying time at Carlstrom Field was only 68 hours.

When we got ready to go to Post Field about the middle of May, Cleo and I found that we had around 250 cans of food I had brought home from Carlstrom during my eight months of duty there (2/3 of my ration allowance). We couldn't take them with us so we sold them to our landlord for $25.

Special Orders #73, HQ Carlstrom Field dated 13 May 1922 sent Cadets Fredericks and Conerton along with us to Post Field, Fort Sill, Oklahoma by train.

Next month I'll tell you about several Carlstrom Field incidents that were worth remembering such as: The time I caught a whooping crane, the time Art Smith managed to total 5 Jennies at one time, the way one

lieutenant followed orders to quit drinking, and others, including our method of getting frogs' legs for dinner. Also, in one word or less I'll cover the enriching experience of a train trip from Arcadia, Florida to Lawton, Oklahoma.

FCC NEWS

220 MHz CB
COMMENT OF IMPORTANCE

The following comment on docket 19759, written by the immediate predecessor of Walker, is of immense importance and a copy of this letter should be sent to your Congressman and your Senators just to back up the comments that have appeared in 73 to the same purpose: Someone appears to have been bought — is that reason enough for a new service to be instituted? And the proposed Class E CB is a whole new service.

Dear Chairman Wiley:

I wish to point out to you that the Commission will commit a very serious error if it adopts the course proposed in Docket 19759 and as urged by the Office of Telecommunications Policy in Acting Director Eger's December 27, 1974 letter to you.

In case you are not familiar with my qualifications to make such a statement, I was the Acting Chief of the Commission's Amateur and Citizens Division at the time of my retirement in 1971, after working 20 years in that area of regulatory activity. Prior to that, I was in the allocations Branch of the Commission's Frequency Allocation and Treaty Division and engaged in monitoring, inspection and intelligence activities in the first years subsequent to my employment by the Commission as a Radio Inspector in 1940.

Former Commissioner E. K. Jett's dream of cheap two-way radio communication for people in all walks of life seemed likely to become a reality when the Citizens (Class D) Service grew so rapidly in the sixties when it was established on the 27 MHz frequencies taken from the Amateur Radio Service. However, the Bureau Chiefs responsible failed to heed staff warnings that this Citizens band would soon become an unmanageable mess if not adequately policed. As a result of the Commission's neglect, the Citizens Service Class D operation has become a shameful disgrace. While the Commission's recent sampling experience with its three field "CB" enforcement teams indicates a potential answer to the establishment of the discipline necessary for a useful Class D service, only the actual application of an all-out effort will prove the Commission can, *and is willing* to do it!

In the face of the foregoing, the Commission's Docket 19759 proposes a new Class E Citizens Service again, as for Class D, taking frequencies away from the amateurs. Even though a potential of several million licensees is estimated by the Electronic Industries Association, no concrete, proven means of maintaining discipline is assured or promised and the Notice vaguely refers only to "... examining a number of various proposals..." (for reducing Class D violations) and to the intent that "... abuses of its Class D rules, and associated enforcement problems, shall [not] be extended to this new service."

It appears that your Chief Engineer is in a big hurry to create a new monster by amending Part 2 of the Rules to allocate frequencies for "it" before he knows how "it" will be put together or how to control it! WHY? Are you and your fellow Commissioners willing and able to commit the funds the Chief of the Field Bureau would need to maintain the disciplined radio service Mr. Eger hopes it would be? If so, why does your Safety and Special Radio Services Chief propose in Docket 20120 to expand the Class D 27 MHz frequency space through rule amendments which are expected to "...enhance the potential of the Citizens Radio Service to provide adequate and efficient radio Communications provided licensees comply, *on a voluntary basis,* with our Rules"? (italics added for emphasis) At least, in this latter proceeding, the Commission and *some* of its staff appear to believe it advisable to re-examine "... the Commission's ability to regulate the Citizens Radio Service in the public interest, the Commission's ability to adequately enforce its regulations, and the ability of licensees and others involved with the Citizens Radio Service to use the Service in a mature, responsible manner."

Mr. Eger's letter observes that "Estimates of the industrial activity contribution of such a service suggest a market size approaching half a billion dollars per year..." and that "...a larger public need for radio justifies the foregoing reallocation." How, when and where has such a need been demonstrated to O.T.P. or to the Commission? Comments by prospective users on the Docket 19759 proposed Class E Service is so light as to be insignificant. In the absence of any demonstration of need, it would appear that the sole benefit to result from Class E would be to the electronic industry which hopes for a new market for equipment. Currently, tens of thousands of newcomers to Citizens Radio operation find their purchase of equipment is wasted because the chaos which prevails on Class D Channels prevents their operation for legitimate purposes. Is it in the public interest to further prime the electronic industries' economic pump from money obtained by holding out a false promise of useful communications to the general public via the proposed Class E Service? In the face of this, it seems strange that some staff members in O.T.P., D.O.D. and F.C.C. are pushing so hard for this Class E proposal.

Mr. Chairman, I urge you and your fellow Commissioners to weigh this matter *very* carefully and consider *all* pertinent information before you decide the Commission's course.

Sincerely,
William S. Grenfell

Before the Federal Communications Commission, Washington, D.C. 20554.

In the Matter of

Implementation of the National Environmental Policy Act of 1969

Docket No. 19555

ORDER

Adopted: January 22, 1975
Released: January 24, 1975
By the Commission:

1. The Commission has before it four petitions for stay of the effective date of its rules implementing the National Environmental Policy Act (FCC 74-1042, 39 F.R. 43834, December 19, 1974). The petitions were filed on January 14, 1975 by the American Radio Relay League and on

January 15, 1975 by Communications Properties, Inc., Midwestern Relay Company, and Teleprompter Corporation. The effective date of the rules is January 20, 1975.

2. The Relay League asks that the rules be stayed until the amateur license application form (FCC FORM 610) has been revised or supplemented to reflect the requirement of submitting an environmental report with certain applications and until the new form has been made widely available to amateur applicants. The League states that information concerning the size and precise location of amateur antennas and supporting structures is not required by the present form and expresses concern that some 8000 amateur applications received monthly by the Commission will be rejected or not acted on for want of a statement that the facilities to be operated by the amateur applicant under his license are "minor" within the meaning of the environment rules. As the League states and as we are fully aware, it would be rare, indeed, for an amateur operator to construct an antenna tower which is 300 feet in height or which would for any other reason be a "major" action within the meaning of the environmental rules. In this respect, we note that structures of 200 feet in height require aviation hazard clearance, where information concerning the height and location of the structure is required, and the need for clearance is made known to the Commission, and that amateur structures in this category are also rare. It should therefore be apparent that we do not intend to reject or hold up amateur applications for want of a statement that the facilities in question are "minor" facilities. The petition for stay submitted by the American Radio Relay League is therefore denied.

3. The three other petitions for stay are essentially identical as to substance and can be dealt with as one. The petitioners request a stay pending action on their petitions for reconsideration. Their principal complaint on reconsideration is that the rules require that an environmental report be submitted with applications for the construction of microwave towers of 100 feet in height and that similar reports are required for other towers in most cases only if they are 300 feet in height. We agree that this disparity is one which should be given further consideration by the Commission. We do not, however, consider that it is a valid ground for stay of the rules. If construction of a particular antenna tower carries with it consequences which are significant for the environment, the public interest will be served by preparation and Commission consideration of an environmental report, and the burden on the applicant is only that which is appropriate under NEPA. If construction of a particular tower does not carry with it consequences of significance, on the other hand, the burden of preparing the report is very slight and processing of the application will not be delayed. The submission of reports concerning towers of varying types and heights during the period in which the environmental rules are being reconsidered, moreover, will provide an improved factual basis for considering which of the many projects authorized by the Commission should ultimately be subjected to routine environmental processing. The petitions for stay submitted by Communications Properties, Inc., Midwestern Relay Company, and Teleprompter Corporation are therefore denied.

Federal Communications Commission
Vincent J. Mullins Secretary

FCC EXAMS AT ROCHESTER

The FCC will conduct amateur radio examinations at the Western New York Hamfest, in Rochester, N.Y., on Saturday, May 31st for General and higher class licenses. Examinations requiring a code test (13 or 20 wpm) will begin at 10 am. Those not requiring a code test (advanced class) will begin at 1 pm. Applications should be submitted with the $4.00 filing fee no later than May 23rd to the FCC, Room 1005 Customhouse, Second and Chestnut Sts. Philadelphia, Pa., 19106. Applications should be marked "For examination at the WNY Hamfest."

A complete Hamfest informational mailing along with a copy of the program will be sent to all on the mailing list around April first. To be included on the list, just send a card to WNY Hamfest, Box 1388, Rochester, N.Y. 14603.

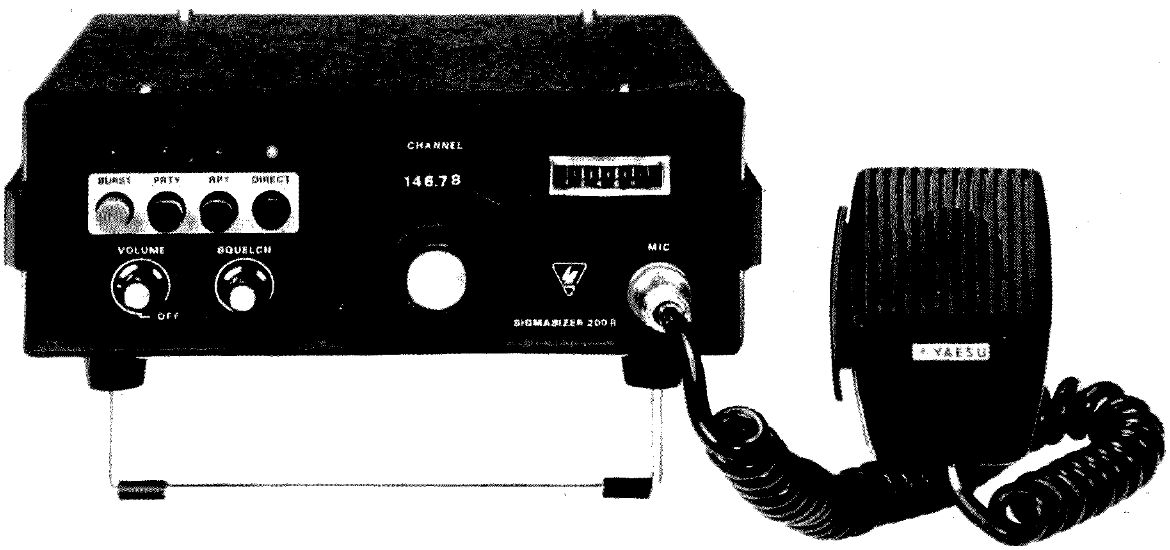
Satellite Orbiting Data

Oscar 6 Orbital Information

Orbit	Date (Apr)	Time (GMT)	Longitude of Eq. Crossing °W
11237	1	0104.2	66.0
11249	2	0004.2	50.9
11262	3	0059.1	64.7
11275	4	0154.0	78.4
11287	5	0054.0	63.4
11300	6	0148.9	77.1
11312	7	0048.8	62.1
11325	8	0143.8	75.9
11337	9	0043.7	60.9
11350	10	0138.6	74.6
11362	11	0038.6	59.6
11375	12	0133.5	73.3
11387	13	0033.4	58.3
11400	14	0128.4	72.0
11412	15	0028.3	57.0
11425	16	0123.2	70.8
11437	17	0023.2	55.8
11450	18	0118.1	69.5
11462	19	0018.0	54.5
11475	20	0112.9	68.2
11487	21	0012.9	53.2
11500	22	0107.8	66.9
11512	23	0007.7	51.9
11525	24	0102.7	65.7
11537	25	0002.6	50.7
11550	26	0057.5	64.4
11563	27	0152.5	78.1
11575	28	0052.4	63.1
11588	29	0147.3	76.9
11600	30	0047.3	61.8

Oscar 7 Orbital Information

Orbit	Date (Apr)	Time (GMT)	Longitude of Eq. Crossing °W
A1708	1	0026.9	56.6
X1721	2	0121.2	70.2
A1733	3	0020.5	55.0
D1746	4	0114.8	68.6
A1758	5	0014.1	53.4
B1771	6	0108.4	67.0
A1783	7	0007.7	51.8
B1796	8	0102.0	65.4
X1808	9	0001.4	50.3
B1821	10	0055.6	63.8
A1834	11	0149.9	77.4
B1846	12	0049.3	62.2
A1859	13	0143.5	75.8
B1871	14	0042.9	60.6
A1884	15	4137.2	74.2
X1896	16	0036.5	59.0
A1909	17	0130.8	72.6
B1921	18	0030.1	57.4
A1934	19	0124.4	71.0
B1946	20	0023.7	55.8
A1959	21	0118.0	69.4
B1971	22	0017.4	54.3
X1984	23	0111.6	67.8
B1996	24	0011.0	52.7
A2009	25	0105.3	66.2
B2021	26	0004.6	51.1
A2034	27	0058.9	64.6
B2047	28	0153.2	78.2
A2059	29	0052.5	63.0
X2072	30	0146.8	76.6



Charles Anzman WB2PVH
2159 Seneca Dr. E.
Merrick NY 11566

The Remarkable Yaesu Sigmasizer

You want to go synthesizer-FM. The reality that buying 12 sets of crystals could have bought you two synthesizers has finally sunk in. Now, a new problem . . . which synthesizer? You could get a Clegg Crystiplexer or one of the newer external synthesizers like the GLB or RP. To add to the growing confusion, Yaesu has just announced their new synthesized transceiver – The Sigmasizer.

The Sig, as we'll call it, is about half the height of your common Clegg and about one inch wider. It has an output of 10 Watts and one Watt in low power. Like the Clegg, it uses some crystals (included) for synthesization (say that three times fast!). The Sig covers 146-147.99 MHz in ten kHz steps, with a five kHz mod in the not too distant future. Both the frequency readout and quote 'S' meter are illuminated. No tuning is required. You just set the dial to your desired channel and you're on. From there, you can operate Simplex (direct) on the dialed frequency or activate the RPT button which will automatically offset your transmitter 600 kHz down in the 146 range or 600 kHz up in the 147 segment. The Sig has a priority position into which you can put crystals for your favorite repeater making QSY to that channel quick and easy. Just push the PRTY button. LEDs are provided to tell you if the rig is operating SMPLX, RPT or PRTY and if the unit is transmitting low power. Additionally, another LED lets you know when you're transmitting. The 200R has a built-in tone burst oscillator with variable time delay, frequency, and amplitude, making it useful for PL and other applications. The unit comes ready to go with molded cigarette lighter plug and microphone. No worry about alternator whine, as the Sig incorporates a built-in toroidal alternator whine filter. Antenna troubles? Don't fret. The Sig has an swr protection circuit which disables the transmitter at higher than a 1.8:1 vswr. Unlike other protection circuits, the disable mode is made obvious to the operator by the transmit LED shutting off one second after pushing the PTT button.

Setting frequency is simple. Two concentric knobs do all the work. The inner knob sets the MHz and 100 kHz digit, and the outer knob sets the 10 kHz increment. The frequency is then displayed on the illuminated dial. No worry about the readouts burning out because it's mechanical. Of course, common features like external speaker jack and plug-in mike have not been forgotten.

Time to get technical. The specifications provided with my prototype were, believe it or not, in Japanese, so I took a few of my own. Sensitivity measured an unbelievable .13 uV for 20 dB quieting. Intermodulation products were down compared to other transceivers we have tested. This might be attributed to the Sig's dual-

filter design with filters in both the high and low i-fs. A Murata 'E' filter keeps things tight but is easily changeable to an 'F' if much splinter operating will be done. The Sig's speaker is bolted to the bottom cover for minimum vibration at low frequencies. Receive quality was good and the unit's audio amp provided plenty of push in the noisy mobile.

The transmitter put out 10.1 Watts at 13.8 volts. It dropped only to 8 Watts at 11 volts and put out 13 Watts when subjected to 15 volts. Audio was good with the provided 600 Ohm dynamic mike (which is directly interchangeable with the FT-101B mike).

It looks like Yaesu's done it again. A synthesized transceiver for the serious FMer.

Construction-wise, the Sigmasizer is excellent. Opening the lid, you see three separately shielded subassemblies. The rf compartment is also separately shielded making TVI virtually non-existent. Operating the Sig right on top of my Sylvania color set resulted in slight bars on channel two. When subjected to the same test, my TR22 (one tenth the power) wiped out the picture.

Temperature changes barely fazed our Sig. When subjected to my mobile environment, which varies from 20 degrees F to about 75 with the heater on, the Sig never wandered more than 300 Hz.

Summing up, the Sig is quite a little box – versatile, easy to operate, and offering many features that more expensive rigs don't. Don't pass it up when it comes your turn to get sick of buying crystals. The price tag? How about 449 bucks, about what you'd expect to pay for a fully crystalled rice box.

Many thanks to Harrison Radio, Farmingdale, for providing our test Sigmasizer.

. . .WB2PVH

N. Tenhulzen
120 S. Jupiter
Garland TX 75042

The Quartz Digital Watch

an electronic marvel

How many times have you missed a MARS net check-in or an important sked with that W6 across the country? In several cases it was probably because your $19.95 drug store special thought there were 63 minutes in an hour instead of 60. I have had this problem on more than one occasion and I think I have found a cure for it. It's called a quartz digital electronic watch. These electronic marvels boast the amazing accuracy of better than five seconds a month. My particular model, an LED type, lights up when a command button is pushed and displays the time in hours, minutes, seconds and also tells me the day and the month (very useful during those long weekends contests).

Operating Principles

Most of the quartz digital watches on the market today operate with the same basic principles. Divide the output from a crystal oscillator down to a one Hz signal to be used to control several types of displays. In most cases, the crystal oscillates between 30 and 1000 kHz (in this particular case, 32,768 Hz). This 32.768 kHz signal is then applied to a divider chain which divides 32 kHz down to 1 Hz. This 1 Hz signal is applied to control logic that routes this 1 Hz pulse to other divide circuits or counters. These counters divide the 1 Hz signal into minutes, hours, days and months (that's a lot of dividing). The outputs from these counters are then applied to decoders. These decoders take the information that once was a 32.768 kHz signal and transform it into signals usable in a seven segment display. All this oscillating, dividing, controlling and decoding is done on a single integrated circuit chip about 150 mils square, and drawing only about 8 microamps.

Most of the work is done by a single CMOS integrated circuit containing over 1500 transistors (another amazing feat). There is even a built-in provision for increasing the brightness of the display when the ambient light level is high. During high light levels, PC1, a photocell, lowers its resistance causing the integrated circuit to increase the duty cycle of the multiplexed seven segment display outputs. The only other parts in the watch are the crystal oscillator circuit components, two 1.5 volt silver oxide batteries, two command switches, the display driver transistors and, of course, the four digit seven segment display itself.

Put all this together and you indeed have an electronic marvel, guaranteed to tell you time and date with 5 seconds per month accuracy, and to run for a year on one set of batteries. Now it looks as though I will have to find a new excuse for missing my next net check in.

. . .TENHULZEN

Ham Help

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number.

Eugene Neigoff
1120 Algonquin, Apt. 2H
Schaumburg, Ill 60172

Johnnie David Twine
T-44 4ATAF
APO New York 09131

Mr. William Prago
2240 Center Avenue
Fort Lee NJ 07024
(201 944-2860)

SPECIAL THANK YOU TO MY ANONYMOUS BENEFACTOR

I cannot tell you how deeply I appreciate your concern for me, as evidenced by the trouble you went to by placing an ad for me in the "Ham Help" column of 73 Magazine.

I hate to disillusion you but I am presently Vice President of Engineering of WSNL-TV here in Central Islip, operating on UHF Channel 67, with a power of 5,000,000 Watts e.r.p. I am a member of SMPTE (Society of Motion Picture and Television Engineers), AES (Audio Engineering Society), and a member of the Board of Directors of the SBE (Society of Broadcast Engineers), and have been engaged in Broadcast Engineering for a mere 18 years! I have been a licensed ham since 1956, first as KN2VGD, and now with Advanced call letters of K2VGD (since 1957).

I don't mean to sound ungrateful, but your concern is not only unnecessary . . . but . . . unwanted.

P.S. I am very willing to render any assistance to any person who is interested in obtaining a license.

. . . Edwin T. Karl K2VGD

73 Inspects Spec Comm

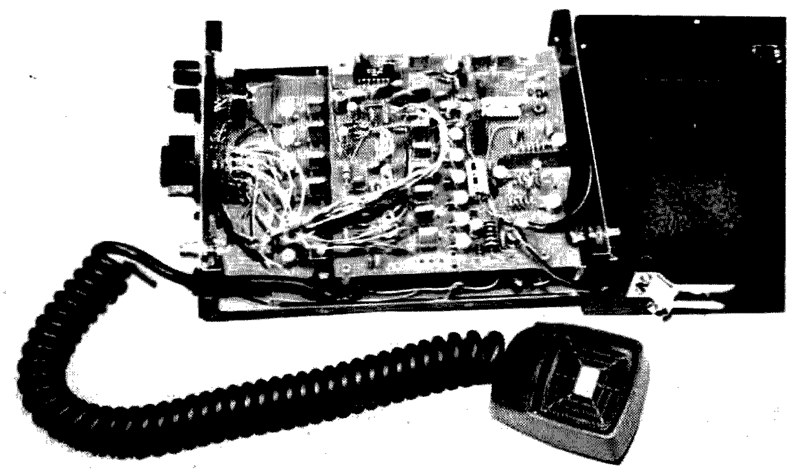
Readers of the ads in 73 may have been wondering about the new two meter FM rigs announced by Spectrum Communications in Worcester, Pa. At that price can they be any good?

We've checked it out at 73 HQ and we want to report that the rig is not just good, it is amazing. The engineers at Spec Comm have applied the latest and hottest IC chips to FM and the result is one of the simplest and most effective rigs on the market.

The receiver centers on the i-f IC which has a four pole crystal filter on the input and a two pole on the output – the result being sharp skirts without all the extra images and other troubles which come with going to a double i-f chain. The mosfet preamplifier and Shottky hot carrier diode mixer go a long way toward eliminating intermod and adjacent carrier interference.

Most of the transmitter is contained in two ICs, including an extremely effective speech clipper/filter which really makes the voice fill out the signal, but without the usual muffled distortion. It sounds beautiful.

There are a lot of details which add up to a remarkable package – such as all solid state switching (no relay to defunct or get dirty), a 3" speaker (which sounds a lot better than the usual 2" jobs), the use of TR-22 crystals (which are available everywhere), a choice of six or twelve channel models (depending on how many repeaters you have around), antenna connections on both front and back of the rig (very handy at times – it also allows clip-on accessories to automatically plug into the antenna input), and one of the best acting squelches we've seen yet.



The accessories help to round out the system – items such as an ac supply which simply clips on the back of the rig ($45) for home use (the antenna jack feeds through so you can still plug in the antenna on the front or rear of the rig). The power supply uses one of the newest silicon-steel transformers (keeps very cool).

There is a nicad battery pack which also clips on the back of the rig, making it a great five Watt walkie-talkie to sling over the shoulder. The nicads are hefty and designed to run the five Watt rig – not your usual penlight size cells which poop out in a couple of hours.

A 25 Watt amplifier clip-on module is also available ($90) which both boosts the power output of the rig and provides a low-noise preamplifier for the receiver.

There is a battery status indicator on the front panel that indicates when it is time to stop talking and service the nicads. Anyone who has over-talked nicads will appreciate the value of this gadget. The indicator is needed because the voltage regulator circuit is so good that the receiver never indicates when the voltage is starting to run low. Hooking up the rig backwards won't blow it either, due to a reverse voltage protector. The final is well protected from shorts or open circuits.

The rig is built on two large circuit boards so everything is right out there easy to check and service – quite a difference from some of the rigs which take a deformed midget to get into.

By virtue of the 1975 type of circuit and direct sale from the factory, the Spec Comm boys are able to make the 560 (five Watts six channel) available for $180. The twelve channel model 512 is $200. There aren't many bargains like that any more.

BE MY GUEST

Visiting views from around the globe.

I HAVE MET THE ENEMY– AND HE IS US

WA8OGS has asked me to write about my patent application. I applied for a patent on a system of Stereo for the Standard Broadcast Band on June 27th of 1968. In the course of the following seven years, I've traversed all the courts.

From the patent office I went to the Appeals Tribunal, after my application was rejected on a simple technicality. One of my claims was not in a one-sentence structure!! This is a no-no. While in the Appeals Court, I had to write my own brief and submit the required number of copies. I had sent my new claims in a registered letter which was signed for. But for some strange reason it was not before the Court when they deliberated in closed session (in camera). I did not know about this until 18 months had elapsed. I became angry and tons of letters were written back and forth.

I decided to fight on. I had a choice of taking civil action against the United States or of going to the U.S. Court of Customs. The latter won out, and I thereby waived my right forever of taking civil action. This is a rule spelled out in USC 145. I lost again after writing and printing 40 copies of a brief. The date was March 21, 1974. I immediately asked for a review. The review was denied May 28, 1974.

It looked like the end of the road for me. I decided I would fight on. I wrote the Clerk of the Supreme Court at 1 First Avenue for an example of a petition. They sent me a petition to use as a format. It was done on 8½ by 13 inch paper and double spaced. I followed this scrupulously. I sent the filing fee too. Three days later it came back with the stamp of the Supreme Court on it. They rejected it and sent me a new rule book. The printing must be done as spelled out in rule 39. Print shall not be less than 11-point type and adequately leaded, and the lines shall not be more than 4-1/6 by 0-1/6 inches. The paper must be of a certain color and it shall be bound.

JOSEPH M. RICE
vs.
THE UNITED STATES

The front cover told the story under the general heading of "Joseph M. Rice versus The United States of America". The argument was now between me and the Attorney General and The Justice Department. The second petition was rejected because I had neglected to show why the Supreme Court had jurisdiction in this case. My answer was that I had exhausted all the Federal Courts below. They accepted this, and I again wrote 40 copies of a new petition with different rules and supplied the Justice Department with three copies as "proof of service". The case was docketed as 74-152.

On November 25, 1974 the Supreme Court denied the Writ of Certiorari. I have now lost in every court in the land. Hopeless? Yes. But somehow I picked up the pieces and found a technicality. The Justice Department had not filed their brief in opposition to my petition in time. They are allowed 30 days plus an additional 20 because it involves the United States. They had gone overtime by almost a month.

I am presently protesting to the Chief Justice, Mr. Warren Burger, and to the head of the Justice Department. I pointed out that even though I am not an attorney I do know the difference between a statute and common law. I am arguing that I had to abide by stringent rules and the Justice Department must do so also. I've had numerous telephone conversations and our language is getting salty! Like I said in the beginning, I've met the enemy and he is US!

. . . W4RHZ

Reprinted from *Feedline*, Northern Kentucky Amateur Radio Club, February, 1975; submitted by Joe Burke WA8OGS.

Nuts to You, Alpha Bravo Charlie!

We are hum-drum, dull and in a rut! I don't know – perhaps things are just different today from when I got my ham ticket (more sophisticated?), but it seems to me some action is in order. What I'm referring to is callsign phonetics.

Way back when (circa '54) everyone truly went to great lengths to put together clever, or odd, or ridiculous phonetics for his (or her) call so it would be remembered. Long after you forgot the QSO and the person, the phonetics would remain – and if you heard them again you would instantly recall. As a matter of fact, almost every QSL card you got contained the phonetics used – something I rarely

see today. For instance, I remember vividly a clergyman I worked on 40 meters about 20 years ago whose call, W8JAP, I never forgot, and, who signed as "Just A Parson." Fritz, back when he used to be W3MCH, was the Most Cheerful Ham, a set of phonetics I dubbed him with and which stuck. Lois W8MHF from Cincinnati was the Mighty Homely Female and Bill, my blind friend from Etna, Pa (W3TOC) was the Tired Old Cowboy. You could forget TOC, but could you forget Tired Old Cowboy?

Today, with some notable exceptions (Little Queer Vampire, Young Girl Chaser, Only In America, Charlie Sends Kisses), we seem to be afraid to budge one inch from Government Suggests We Use.

It is high time the chains of verbal bondage are smashed.

Undoubtedly, with very little thought, you can do much better than what follows. However, for your consideration, I offer these random possibilities: Hot Rotten Nasty, Tired Used Nash; Some Kinda Queer; Uncle Sam's Cousin; Uncle Tom's Cabin; Poor Yellow Fig, American Car Tester; South Eastern Yankee; Hippy Yo Yo; Mighty Shota Whiskey; and on and on. Used for instance as: This is W3HYY, the Hippy Yo Yo.

Some calls are impossible to do much with and some merely lend themselves to such ribald thoughts as to be better left alone. If my call was W3GFY I probably would have long ago been thrown off the air. Then there are those calls with X's in them which are really deadend streets right away. Beyond Never Xray Unicorns, where can you go?

The FCC insists that you use your call with phonetics only if conditions warrant. I say nonsense. (With all the stations we have on the repeater nobody can be remembered anymore with help.) Believe me, it is much easier to know that Fritz is the Cold Blooded Vampire or the Chocolate Bagel Vendor . . .

So let's get our imaginations working and get some life into those hackneyed letters. And maybe someone will come up with a better one than the best one I ever heard — probably 15 years ago — mobile in N.Y., where a fellow let it all hang out and K2HMJ became Keeper to Her Majesty's Jewels. See — I never forgot!

. . .Jules W3YZE
3 Yaks, Zebras & Elephants

Reprinted from *The Modulator*, Baltimore Amateur Radio Club, Inc., January, 1975.

Guest Editorial: Counterpoint

FM vs. AM

Response to VE3DNR
(73 Magazine, February, 1975)

Hey — Wait a minute! Let's forget about comparing 40 Watt FM transmitters against 10 Watt AM transmitters, claims of different antenna gains for the two modes, and loaded statistics that scream "foul". Let us look at the receiver, and its bandwidth.

Looking at my copy of "Amateur Single Sideband", Collins Radio Company, 1962, First Edition, I find a chart comparing FM and SSB on page 11, figure 1-5. Unfortunately, the signal to noise ratio at the crossover point is not given. We must use a small amount of simple math to approximate the signal levels at which the performance is equal. Please note that the FM bandwidth is given as 12 kc, the current commercial two-way radio bandwidth, and that for most modern amateur repeaters, not 30 kc as remarked on by VE3DNR.

The chart on page 7, figure 1-3, compares AM and SSB using sine wave modulation. Let us make a few notes and additions to the chart, in the portion identified as block "E", or, "noise voltage, arbitrary noise power per kc of bandwidth." Remember, we speak of equal noise *power* per kc of bandwidth, but we measure *voltage*. The figure given for 3 kc bandwidth is .07 Volt, and for 6 kc bandwidth, the figure is .1 Volt. By simple calculation, the figure for 12 kc bandwidth is .14 Volt. If it seems that rabbits are starting to come out of the hat, keep in mind that twice the reference voltage also means twice the reference current, therefore a power ratio of 4 to 1, or 6 dB. For a 3 dB increase in power, a ratio of 2 to 1, the voltage increase would be the square root of the power ratio, or 1.4 (approximately).

In a modern FM receiver with good capture ratio, an incoming carrier 3 dB above the noise in the FM i-f strip will quiet the noise as heard in the loudspeaker approximately 20 dB. For various reasons, an FM carrier is not ordinarily modulated the full 12 kc bandwidth of the receiver, but is usually limited to about two thirds of the allotted bandwidth. This in turn means the signal to noise ratio at the loudspeaker is considerably less than 20 dB, but is on the order of 10 or 12 dB. Looking at the i-f voltage level, this means an input signal of .2 Volts at the FM receiver i-f strip. (3 dB above the noise voltage of .14 Volts.)

In the comparison AM receiver i-f strip, .2 Volts input, with .1 Volt noise equals 2 to 1 voltage ratio, 4 to 1 power ratio, or a signal to noise ratio of 6 dB. By VE3DNR's figures, this is about the usable limit. Calculating the SSB signal to noise ratio, we come up with .2 Volt signal, .07 Volt noise, or a 3 to 1 voltage ratio or 9 to one power ratio, very close to 9 dB signal to noise ratio. No surprise here, as we already knew SSB has a built-in 3 dB advantage over AM.

Extrapolating to zero is a dangerous business, but dropping the signal levels 2 dB would drop the AM signal to 4 dB signal to noise ratio, and by VE3DNR's own reckoning, this is the level of unusability. Not having any accurate figures on the FM threshold effect, I will assume that a 2 dB drop in input signal will reduce the FM receiver recovered signal to noise ratio to 5 or 6 dB, or barely usable. Of course, proper speech processing can be applied to all three modes, and will help all, but I feel that I have shown that the FM signal, on its own, without any concessions, is at least the equal, and in some ways the superior of AM. In practice, full bandwidth use in FM (using the full 12 kc receiver bandwidth) would far surpass AM, and approach the performance of SSB at the 3 or 4 dB signal to noise ratio. I myself am lazy enough to want at

least a 10 dB signal to noise ratio from the loudspeaker, and at this level, FM clearly surpasses both AM and SSB. As for VE3DNR's statement that SSB or CW is the only way to work truly weak signals, I would like to mention FSK RTTY. It is a form of FM, and will outperform both SSB and CW. My reasons for writing this included his unfair claim of a 64 to 1 "stacked deck" situation in the FM vs. AM conflict. I submit that the FM mode is superior in usability, defined as a 10 dB or better signal to noise ratio at the loudspeaker.

Much could be said about BCI (SSB isn't BCI-free, it's just unintelligible to the non-ham) and power output efficiencies, but I rest my case.

...WØDKU

Again QRZ . . . QRZ . . . at Hattingspruit

The weather report on the evening of the 13th of June, 1974, forecast rain for the area. Mr. I. McCallum, an engineering draughtsman of Hattingspruit, got up at 5 a.m. the next morning, glanced out of the bedroom window, expecting to see the rainy conditions that had been promised. Instead of a cloudy sky he saw the stars shining brightly and an intense bright white light coming, it appeared, from an object in the sky. Calling his wife to see this unusual light they both went outside to have a better look. Mr. McCallum said:

"I looked in the direction of this bright light through my 10-50 binoculars and saw a cylindrical object. It was about the size of a Boeing 737, but without wings or tail-fins. I could not see the ends because of the intense brightness of the light. I could also see a row of square portholes in the centre and strong white light beams were shining from these towards the ground. During the first hour of observation the UFO zigzagged along at a leisurely pace with the lights coming from the portholes shining towards the ground almost as if it was looking for something! It was cold and clear, there was no sound at all and it was at a low altitude and quite near till about 6 a.m. After 6 a.m. the craft started ascending and just before sunrise the light from the object was as strong as the morning star. The ascent of the UFO was rather strange, while seeing it on end view I could see red lights flashing upwards from the body. It ascended in the direction of these reddish lights each time a flash was emitted, and so it ascended zigzagging upwards. At approximately 6 a.m. the UFO switched off most of the side lights from the portholes and after sunrise the craft could still be seen with one light shining and the sunrays reflecting off the body. From 6 to 9 a.m. it was still visible in the sunlight if one was shown the position but then it was too high to be photographed; earlier no photograph was taken as I had no camera or telelens available, but there are three other witnesses besides my wife and myself who saw the UFO. My wife looked at the intense brightness of the UFO during the first hour or so, mostly without binoculars and she ended up with 'arc eyes' due to the intensity and brightness of the light."

This is another one of these strange phenomena. In this case the craft was close enough for the square portholes to be seen. The question arises, where does it come from and what is it doing here? For an answer to this enigma we must look to the experts and see what they have to say. Professor Carl Sagan of New York's Cornell University said in a recent report that a growing number of scientists believe there may be life on other planets and that we may receive their message in our radio telescopes any day.

The mindbending Uri Geller, who is causing shock waves in the world of science with his remarkable feats, has said that a contact with extra-terrestrials could take place on a large scale in about three years time.

We can but wonder at all this. In the meantime sightings like the one above continue to take place all over the world! You could help in the investigation of this problem by reporting any unusual happenings such as the above in the sky, or on the air (such as LVE, see Radio ZS July 74, P 8) by writing to me: ZS5GZ, P.O. Box 15, Wandsbeck, Westville 3631, Natal. Who knows, you may be coming up with the missing parts of the puzzle. These reports would be sent to MUFON, the Mutual UFO Network in USA where a panel of experts are evaluating all these data from all over the world.

...ZS5GZ

Reprinted from *Radio ZS*, Official Organ of the SA Radio League, November, 1974.

73 in the works

- Fantastic 2m Converter from K1CLL – plus more on the 432er
- Solid State Burglar Alarm System
- W2AOO's Fat Nixie Clock
- Slow Scan Hard Copy Machine
- More K2OAW digital stuff
- Postage Stamp IC Squelch
- Simple Approach to Satellite Communications
- ID Timer
- Mini-repeater
- TT-63A Regenerative Repeater
- Rock Solid Tone Encoder . . . simplified
- Mother's Day Special: LED Violet Checker

UP COMING

Big Auction Near Boston

Saturday April 12th is the day – Eagles Hall, Litchfield Street off Route 12, South Leominster, near the Leominster Motor Inn – 1pm. Bring lots of gear and lots of money – take the reverse home. 10% of sales goes to the MARC. Flea market space available. This has been a big auction, growing every year. Dig into your pile of unused gear and get it into eager hands. Come and get some fantastic bargains. You'll find the spillover from a hundred electronic plants here . . . plus plenty of ham gear.

Caveat Emptor?

PRICE — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue. For $1 extra we can maintain a reply box for you.

VERY INTERESTING! Next 5 big issues $1. "THE HAM TRADER," Sycamore, IL 60178. (Information about our "HAM EQUIPMENT BUYERS GUIDE" covering equipment 1945-75 included. Nostalgia! Helpful!)

MOTOROLA PAGEBOY, carrier squelch on 147.72, .3 mV for 20 dB charger, Batt $135. Jim Maloney, 2670 Tierra Cir., Winter Park FL 32789. Ph 305-678-0244.

RTTY FOR SALE: Model 15-19 friction-feed conversion it, $13.00, Model 28 style table-stand, $25.00, Model 15-19 printer bases, $7.00, Model 28ASR motors, $25.00. Model 28 printers, gearshifts, cabinets, parts, accessories. SASE for complete list. Motorola T53GKT, Mint, $225.00. Antique tubes. Lawrence R. Pfleger, P.O. Box 21956, Milwaukee WI 53221.

"FM BASH", DAYTON, OHIO While at Hamvention, come relax with us at Imperial House North, 9PM til?, Friday, April 25. Prize drawing at 11PM featuring ICom 230 and much more. Free admission, snacks, COD bar, entertainment, tables for ladies. Miami Valley FM Ass'n., K8SNJ, 725 Parkview, Dayton, Ohio 45403.

CRYSTAL PACKAGES with the purchase of any 2 meter FM radio. Write for our deal on the rig of your choice. Factory authorized dealers for Collins, Regency, Drake, Icom, Atlas, Alpha, Kenwood, Tempo, Ten-Tec, Swan, Clegg, Genave, Standard, SBE Midland, Hy-Gain, CushCraft, Mosley, Hustler, plus accessories. For the best deal around on HF or VHF gear, see us first or see us last, but see us before you buy. Write or call us today for our low quote and become one of the many happy and satisfied customers of Hoosier Electronics, R.R. #25, Box 403, Terre Haute, Indiana 47802. (812) 894-2397.

STATION Identification collectors, swap cassettes of local PBS, 2 mtr rptrs, and BCB. Arnold Timm, 3207 4th St. N. Mpls., Mn 55412 (SASE Mpls, list).

FOR SALE Collins 32S-1 $300.00 Call after 6PM Eugene Rhodes WB4JCV, 227 Edison Drive, Pensacola FL 32505. (904) 453-3844.

FOR SALE. Antique radio collection. Includes, Grebe Synchrophase, Philco 511, Kilster 6-D, Several A-K models. Contact Ernest Prince, Rt 2 Fairwood, Union, SC 29379.

$75 PLUS U.P.S. buys a Deltron No. 1980 dc power supply — variable 0-15 V dc, 0 to 10 Amps with voltmeter and ammeter. Well regulated. Martin Shapiro, 1138 Boxwood Rd, Jenkintown PA WA3IFQ.

TECH MANUALS — $6.50 each: R-220/URR, URM-25D, USM-159, USM-16, PRC-10. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

WANTED — Catalog sheet 1971-72, Sears, Ward, Admiral, etc. Color television and recorder; also cartrivision cassettes and matching Sears TV cheap. W4API, Box 4095, Arlington VA 22204.

LOGIC PROBE KIT! . . . Now a digital Logic Probe Kit at a realistic price. Red, green and yellow light emitting diodes signal the presence of logic levels encountered in TTL digital circuitry. Utilization of transistor and integrated circuit switching techniques permit the Digapeake-A to indicate logic 1, logic 0 and pulsing circuit conditions. Complete kit including easy instructions is available now from Cheasapeake Digital Devices Inc., Dept F, P.O. Box 341, Havre de Grace, Md., 21078. Satisfaction guaranteed. Order yours today. $14.95 plus shipping. Maryland residents add tax please.

PUSH-BUTTON TELEPHONE to step dialing IC $10.00, TCA430 Quad tone generator $3.00, Memory plane 20k bits $12.00, Wire — 18-2 $15.00, 18-3 $21.00, 20-2 shielded jacketed 1300 ft. $29.00. All above stranded, twisted #26 solid $10.00M, #30 solid $10.00M. PC Board. Some pieces discolored. All G10. 4¼" x 24" x 3/32" one sided 2/$2.00. 7½" x 16" x 3/32" $1.50. Following 1/16" two sided 6" x 18" $3.00, 8" x 18" $3.50, 9" x 18" 2/$6.00. Large SASE for list. Interested in quantities of some Mos and special chips. Nothing prepaid. Doug Craton, 5625 Balfrey Drive, West Palm Beach FL 33406.

SLOW SCAN TV Monitor Kits, Venus Scientific Model SS2K $235.00 each while they last. 73 Magazine.

FOR SALE — HT220 — 2 frequency, 2 Watt, slim line, 2 new batteries, charger, case, built-in mini-touch tone pad. Working on 2 meters. $350.00 or best offer. 305-678-0244. Jim Maloney, 2670 Tierra Circle, Winter Park, Florida 32789.

NEW YORK CITY Second Annual Hall of Science Radio Club Auction Flea Market Saturday, June 7, at Worlds Fair Grounds, Flushing L.I. No sellers commission but 10% fee on auctioned items. Admission $2.00. Zoo, boating, childrens farm, art and science museums adjacent. Field Day goodies galore. Box 1032, Flushing, 11352.

PHILLIPS CODE, complete copy of 62 pages. $10 postpaid via insured parcel post. Dr. Hess W6CK, P.O. Box 19-M, Pasadena CA 91102.

SWAN 270 AC/DC $350. Swan 250C and 117XC $350. Kenwood R599, matching speaker, 2 and 6 meter converters installed, $300. Gonset G50 $70. Clegg 22er $125. Drake 2nt $80. Hammarlund HC-10 sideband adaptor $75. More. 212 641-2559, Colella WA2HQD, 105 18 131 Street, Richmond Hill NY 11419.

WANTED License Plates. Ham, motorcycle, personalized. U.S., Canada, Foreign, describe, Pay 1-5 dollars each. "Automobile License Plate Collectors Association," Member No. 1560, 5015 Albertly, Parma OH 44134.

NORTHWESTERN Pennsylvania Swapfest, May 3. Crawford County Fairgrounds, Meadville. Flea market begins 10 am. ($1 to display) Free admission, hourly door prizes, refreshments available. Commercial displays welcome. Indoors if rain. Talk-in 146.94, 146.04-.64 and 29.0 MHz. Map and details: RAE, Box 844, Erie PA 16512.

HAMFEST! Indiana Friendliest and Largest Spring Hamfest. Wabash County ARC's 7th Annual Hamfest will be held Sunday, May 18, 1975, rain or shine at the 4-H Fairgrounds in Wabash, Indiana. Large flea market, technical sessions, Bingo for XYLs, free overnight camping, plenty of parking. Lots of good food at reasonable prices. Admission is still only $1 for advance tickets, $1.50 at the gate. For more information write: Bob Mitting, 663 Spring St., Wabash IN 46992.

WANTED: ARRL Handbook T-9er, 6 band CW transmitter or any parts needed for construction of same. K7BD, 103 E. Bartlett, Selah WA 98942.

FOR SALE: General Radio Time and Frequency Standard, including 11018 Oscillator, 1102A Multivibrator, 1102A Power supply, 1103A Syncronometer, and 1107A Interpolation Oscillator. All operating with Tech Data, rack mounted. Will deliver in S. Cal. Best offer. D. Blackmer WA6UNK, Rt 1, Willow Rd, Nipomo, CA 93444.

FREE MANUAL with purchase of classic old General Radio 650-A impedance bridge (with 650-P1 oscillator/amplifier). Operation and calibration guaranteed. Appearance good or better. $90 FOB Modesto (45 lb.) or $80 for any unsold after June 1st. Write for specs: Massingill's Mechanigraphs, 2500 Young Rd., Modesto CA 95351.

SELL: Atlas 180 transceiver. Absolutely mint condition, used only few hours. Latest production model with 8 pole filter and new ALC control. $350. Schultz, c/o RLC, 30 East 42nd St, NYC 10017. Call 212-867-5200.

FM-YOUR KNIGHT TR-108 Complete kit. Use xtal-vfo. $19.95 ppd. Check or M.O. Calif. res. 6%. Revilo Color, 4725 W. Washington BL., Los Angeles, CA 90016.

COMPLETE QSL Catalog! Hundreds of cuts, stock and ink samples. Ten sample QSLs 25¢. Corneilson's Quality QSLs, 321 Warren Street, N. Babylon NY 11704.

SELL MANY OLD ham and radio-serviceman type magazines, handbooks, callbooks, texts, etc. SASE for list. Henry Shaw, 508 Alexander Ave., Cape May Point NJ 08212.

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send SASE showing make and model number. Joseph C. Crockett K3KUL, 762 S. Gulph Road, King of Prussia PA 19406.

STANDARD, SR-C-145 Handy-talkie, 19/79, 25/85, 28/88, 78/18 xtals supplied; one spare with Nicads and ten-tec 1 amp supply/charger. $200.00 W1MBX, 21 Nancy Mae Ave, Prospect CT 06712. (203) 758-5858.

FOR SALE: Hewlett-Packard HP-45 calculator in excellent condition with nicads, charger, handbook, etc., $295.00. Write David Bonham WB4HKY, 36 Hilltop Road, Canton NC 28716.

SOCIAL EVENTS

DAYTON OH
APRIL 25-27

Dayton is the big one – with about 10,000 expected this year. It has the biggest in manufacturers' displays – the biggest flea market – the biggest program. If you only get to one convention a year, this is it.

While the major action is on Saturday, there is so much happening that day that you'll do well to pull in on Friday and spend that day visiting the commercial exhibits. Manufacturers and engineers will have more time to talk with you then – and on Saturday you may have a tough time even getting close to the booths. You just might miss some of the fantastic bargains out in the enormous flea market, too. Bring money.

The crooks know you're coming, so be sure to take your rig out of your car at night – a lot of rigs got stolen last year from the motel parking lots. Bolting it in better is not the answer – one gal had her dashboard chopped out, complete with 2m rig.

Say hello to the 73 staff.

BROOKLYN NY
MAR 29-APRIL 6

The Radio Society of Greater Brooklyn will hold its first annual Worked All States Week Contest March 29 0001G to 2359G April 6. Winner will be the one to work all states in the shortest period of time. Anyone who works all states within the period will receive a certificate. Special certificate to the Novice who works the most states and operator working most states under most unusual conditions. Number of states only counts, not number of QSOs. Logs must include description of your station and the time, date, call and state of all stations worked. Any legal band, mode or power. Send logs to F. Grossman WB2BXO, 9519 Ave. M, Brooklyn, NY 11236.

WESTLAKE OH
APRIL 4

Westpark Radiops W8VM auction April 4 at 8 pm at Clague Park Cabin-Clague & Hilliard Roads in Westlake. Magazines, surplus gear, used & new equipment, components, Ollie Rathburn, Auctioneer. All items can be viewed before sale, coffee & donuts following.

TOWSON MD
APRIL 6, 1975

The Greater Baltimore Hamboree will be held at Calvert Hall College, Putty Hill and Goucher Boulevard, Towson, Maryland (one mile south of Exit 28 of Beltway-Interstate 695), on Sunday, April 6, 1975 at 9 am. Food Service, Flea Market, Contests, Prizes. Registration: $2.00. Complete table set-ups indoors. INFO: Joe Lochte, 5400 Roland Avenue, Baltimore MD 21210 or Brother Gerald Malseed, 8102 La Salle Road, Towson MD 21204. (301) 825-4266.

DETROIT MI
APRIL 6

The Seventeenth Annual SEMARA Swap 'N' Shop will be held on April 6, 1975, from 8:30 am EST to 3:30 pm EST. It will be held on the east side of Detroit, Michigan at Cannon Recreational Center on East Warren and Cadieux Avenue.

JOHNSON CITY NY
APRIL 19, 1975

The Sixteenth Annual Hamfest, sponsored by the Southern Tier Amateur Radio Clubs, is scheduled for 10 am, April 19, 1975, at St. John's Ukrainian Hall, Johnson City, New York. Admission to lectures and flea market only, $1.00 for adults. Total admission, including awards and excellent dinner, $6.50. For tickets or further information, write to: STARC, P.O. Box 11, Endicott NY 13760.

COLUMBUS GEORGIA
APRIL 19-20

The Columbus Georgia Hamfest sponsored by the Columbus Amateur Radio Club will be held April 19-20, 1975.

Activities will begin with the flea market at 1 pm Eastern time on Saturday and finishing with the main prize drawing at 2 pm Sunday.

For information and reservations contact Gary L. Kindred, 293 Nightingale Drive, Columbus, Georgia 31906. Phone 404 689-4494.

RALEIGH NC
APRIL 20, 1975

Third Annual Raleigh Amateur Radio Society Hamfest will take place all day Sunday, April 20, 1975, at Crabtree Valley Mall, Hwy 70-W, just

... continued on page 16

SOCIAL EVENTS from page 15

west of the city. A covered flea market, bigger than ever; many great prizes; group meetings will be featured. General admission $2.50 ea. Food at reasonable cost. For flea market reservation and other info write: George Richards WA4EKJ, Chairman, RARS Hamfest, P.O. Box 17124, Raleigh NC 27609.

GRAND RAPIDS MI
APRIL 24-26

Grand Rapids Annual Communication Show and Swap 'n Shop. On the Mall exhibits April 24-26, 1975. Ham and Electronic Swap 'n Shop April 26, 1975. At Eastbrook Mall on East 28th Street (N.E. corner of M11 and M44). Contact Bob WN8PTM, P.O. Box 2402, Grand Rapids, Michigan.

DAYTON OHIO
APRIL 25

"FM BASH", an annual affair will again be held on the Friday night of Hamvention, April 25, at the Imperial House North. Sponsored by the Miami Valley FM Ass'n., it will run from 9 PM til?, and will include a prize drawing at 11 PM, featuring an IC-230 transceiver. Admission to this social event is free, with snacks and a COD bar, entertainment, ladies' tables and more. Contact K8SNJ, 725 Parkview, Dayton, Ohio 45403.

LA MESA NM
APRIL 26-27

The 11th Annual "Whitey's Bean Feed" will be held at La Mesa, NM near Las Cruces, from noon, Sat., April 26 through Sunday the 27th. Sponsored by Mesilla Valley Radio Club with "Whitey" K5ECQ as chef. Swapfest, chili bean feed, beverages, prizes and "eye-ball" QSOs, free camper parking on grounds Sat. night. Adults $3.50, kids $1.50. Talk-in on 16-76, 52 and 3940 kHz. For info contact K5HZH, 1020 Circle Dr., Las Cruces NM 88001.

AMBOY IL
APRIL 27, 1975

Rock River Radio Club Hamfest, Sunday, April 27, 1975. Same location as in past year's at the Lee County 4-H Club Center, Amboy, Illinois. 1 mile East of Junction Rt52 & Rt 30, South of Dixon, Illinois. Advanced Tickets $1.50. Gate $2.00. Special to April 1, 1975 4 tickets for $5.00. Rain or shine, indoor facilities, etc. Camping area. Limit 1 table free per party. Additional tables $5 each or bring your own. Talk-in frequency will be 146.94 mc.

SAN DIEGO CA
MAY 2-4

This year's West Coast VHF Conference will be held at the Sheriden Inn on Harbor Island in San Diego on May 2-4, 1975. Tech talks are sked for Sat. 3rd, from about 9 am to 5 pm; prize drawing; Noise Figure contest Sat evening; Antenna measuring contest Sun am Pre-reg is $2.50, hotel accomos are $21 single, $27 dbl. More info will be sent later to those on our mailing list. Those who don't get one should drop a line for info sheet, etc, to Louis N. Anciaux WB6NMT, Spec Comm Sys, 4519 Narragansett Ave, San Diego CA 92107.

CONNECTICUT
QSO PARTY
MAY 3 to MAY 5

Contest period 2100 GMT May 3 to 0200 GMT May 5. Certificates to highest scorer in each ARRL section or Province and each Connecticut county. Special – Worked All Connecticut Counties certificate. Trophy to highest scoring club entry. For info write Candlewood Amateur Radio Assn., c/o Donald Crosby W1EJM, 10 Royal Rd., Danbury, Conn. 06810.

CADILLAC MI
MAY 3

The Wexsaukee Radio Club announces their 15th annual Swap-Shop and Eye-Ball that will be held May 3rd in the National Guard Armory in Cadillac, Michigan starting at 9 am This Swap-Shop is open to all radio amateurs, CBers and anyone interested in radio communications. Lunches will be available at noon and there is lots of free parking. Tickets available at the door. All are invited.

ST PETERSBURG FL
MAY 4

The St. Petersburg, Florida, Amateur Radio Club (SPARC) will hold their annual Hamfest at Lake Maggiore Park, Sunday, May 4, 1975. Tables will be available for sales or trading of used and Home brew equipment as well as home-made Arts and Crafts items.

GEORGIA QSO PARTY
MAY 10-12

Starts: 2000 GMT, Saturday, May 10, 1975

Ends: 0200 GMT, Monday, May 12, 1975

The 14th annual Georgia QSO Party is sponsored by the Columbus Amateur Radio Club, Inc. There are no time or power restrictions and contacts may be made once on phone and once on c.w. on each band with each station.

For further info contact John T. Laney, III, K4BAI, P.O. Box 421, Columbus GA 31902.

WEST LIBERTY OH
MAY 18

The Champaign Logan Amateur Radio Club will hold their annual flea market and auction May 18, 1975 at 12 pm at the West Liberty Lions Park, West Liberty OH. Talk-in on 146.52 and 146.13/73.

NEW PRODUCTS

Making PC Boards Easily

A new kit for the stamping and etching of printed circuit boards is being successfully marketed by M Tech Engineering Corporation of Springfield, Virginia. Probably the biggest stumbling block and the principal reason for the oft-declared (but certainly not proven) decline in home brewing has been a complete lack of the simple, inexpensive and flexible equipment required for making PC boards.

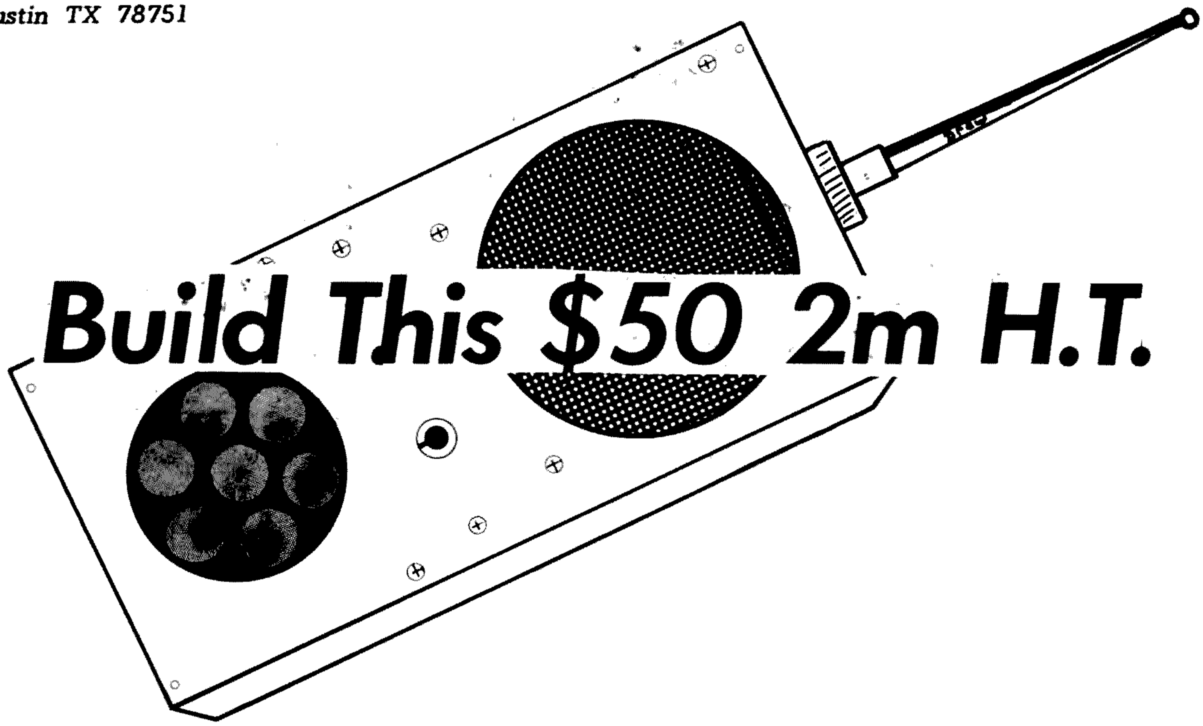
The number of articles appearing in the past year not requiring PC boards has been minimal. This system consists of a series of stamps, a stamp pad with special resist-ink, and a resist-ink fiber tip pen. It is so simple and fool proof that the world's worst klutz can make high quality professional boards. One of the more experimental individuals we know built a digital clock, 3 QRP transmitters, a new front end for a frequency counter and a prototype VFO – and still has two thirds of the bottle of stamp resist-ink left.

Like any system, this one appears at least as fool proof as the fool using it. One word of caution: Don't put too much force on the stamp when printing or it will blob. TLT (tender loving touch) should be the rule.

The 73 staff was quite favorably impressed with this product and found no real need for any additional stamps other than supplied with the kit.

J. R. Johnson WA5RON
4558 Avenue A #205
Austin TX 78751

Build This $50 2m H.T.



Why should two meter portable rigs be so expensive or difficult to build? Believing that they should be neither, I set out to construct a 1 watt walkie-talkie that other hams can duplicate in a couple of evenings' work and at an expenditure of less than $50.

How can that be? Simple and cheap pre-fab receiver and transmitter modules offered by various 73 advertisers can be used. Most of the design work is done for you, but you will have to find (or build) a case, position controls, and perform the human engineering that will result in a custom hand-held that you can proudly claim as homebrewed.

The Transmitter

The transmitter for this project is the TX-144 kit from VHF Engineering. (1) The kit goes together in four or five hours, and is a real pleasure to build and tune up. The transmitter as it comes has only one crystal socket, but you can add an outboard switch and more sockets, if desired, for multichannel capability. You should order some xtals from your favorite quartz grindery when you send for the transmitter. Crystals are the 12 MHz type, HC-25/U ground at 20 pf. Using a multiple of 12, base frequency for 146.94 is 12.245, and 146.34 is 12.195.

In the prototype unit, the transmitter strip is attached to the case front by four copper brackets, 1cm wide and about 5cm long. These were soldered to the circuit board corners at one end, and the other end bent out about 1cm and drilled for a 4-40 mounting screw.

A dynamic mike is needed to drive the transmitter, and I found that the surplus HA1 (earphone) element from a field-phone handset gives excellent audio quality when epoxied in behind a 1-3/8 inch hole in the case front. If pocket-size compactness is desired, the receiver speaker could double as a mike, but this may require additional switch complexity and a mike preamp. Separate speaker and mike were employed in the prototype unit.

The Receiver

Olson Electronics (2) sells a Windsor Weather Radio model 2094 which is a small, oval, desk-top FM receiver tuned for the U.S. Weather Service VHF broadcasts on or about 162.55. Some other stores sell similar VHF monitors at a higher price, and if you already own one of these, perhaps the simple conversion for the Windsor set will apply.

Disassembly of the receiver will yield a

speaker, knobs, sturdy 19 inch telescoping antenna, and a compact oval-shaped receiver board. You might save the nice plastic case for building an intercom station or something. Check the receiver for operation before you start modifying it. Don't worry about the modest audio output, that will improve when you increase the input voltage from 9 to 12 V.

Tracing back from the antenna connector you will find a 9 pF capacitor. Replace it with a 47 pF or larger. Following that is a 3-turn rf input coil. A second rf coil (3 turns) paralleled by a 30 pF capacitor is the tuned circuit for the preamplifier. Melt out the beeswax and replace this capacitor with a 39 pF silvered mica. Another three turn coil near the center of the circuit board (paralleled by a 20 pF cap.) is part of the oscillator. The receiver local oscillator is slightly tuneable and operates 10.7 MHz down from the receive frequency. Replace the 20 pF with that 30 you took from the preamp.

Examination of the tiny schematic packed with the receiver shows the 9 volt input line running directly to the audio amplifier, but separated from the rf stages by a dropping resistor. The audio section seems to work quite happily at 12 volts, but the other stages should be held below 9 volts by the addition of a zener diode (SK3060 or equivalent). This will fit on the board in a small space just beside the audio interstage transformer, between it and the oscillator components.

On the underside of the circuit board you should find a jumper wire between two ground strips. The jumper jumps over a third strip that is the negative lead to the rf stages in the receiver. Drill a tiny hole (no.60) in this strip about 3cm from the tuning capacitor shaft. Drill another hole in the ground strip that goes to the volume pot shaft, 3.2cm from the center of that pot shaft.

Mount the zener on the component side with the cathode to ground (positive ground). This will allow the use of 9-12 volts input without damaging sensitive components.

At this point you may wish to consider the switching arrangement of your transceiver. I chose to replace the 5k volume control pot with one containing a SPST switch (Olson VC-302B). While you are there, you might also improve upon the work of the original Chinese assembler.

Of the several units I have examined, each had electrolytic capacitors sticking up on 5mm of excess lead, long loops of jumper wire, component leads bent over instead of being clipped off, etc. Dress up the wiring a bit, and your receiver will not only squeeze into a tighter space, but may also last longer.

A word of warning: the tuning capacitor is easily damaged by heat. At the close approach of a soldering pencil, that polyethylene spacer between the plates will shrivel up. You would do well to place an appropriate sized washer over the capacitor to protect it during these modifications.

Now, with a small screwdriver or pick, dig out the wax from around the three turn rf coils. With a soldering iron, melt out sufficient wax to allow easy spreading or squeezing of the coils with a plastic tool (save the wax and melt it back into the coils when you are finished tuning).

Start with the oscillator coil, nearest the center of the board. Spread or squeeze to bring the oscillator to 135.8 MHz with the fine-tune control set half way. You can tune by following the oscillator output on a tuneable VHF receiver (aircraft-police mon-

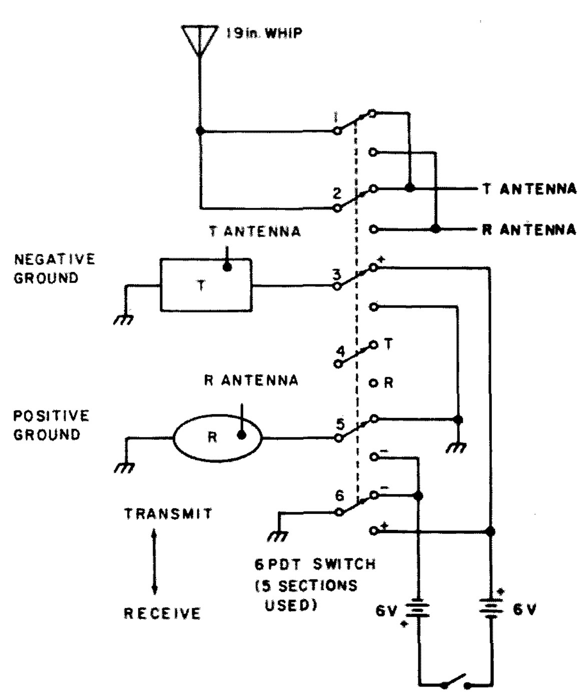


Fig. 1.

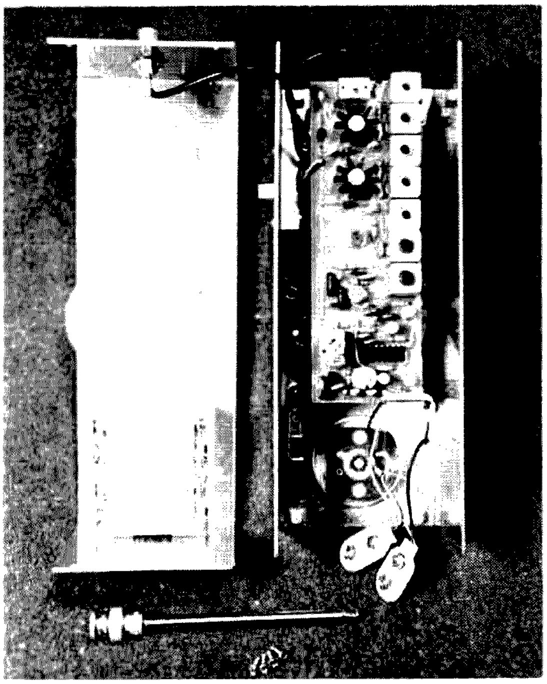
itor) or just by listening for signals on the two meter band.

If the oscillator will not go low enough with the coil squeezed tight, then solder that 9 pF capacitor you removed earlier across the coil on the circuit side of the board. This was necessary for one of the three receivers I tuned up on 2 meters.

When you are hearing signals from amateur QSOs or from a signal generator at 146.5, adjust the antenna and rf amplifier coils for maximum sensitivity. The i-f and detector settings should not be changed. Filling the coils back up with beeswax will reduce the microphonic speaker-vibration feedback problem common to cheapie VHF receivers.

An additional stage of rf amplification using a low-noise FET has been successfully used by the author on the front end of such receivers, but was not added in this hand unit. Good circuits for FET preamps can be found in 73 Magazine (3).

When the receiver is mounted in a metal case, the ground circuit should be connected by a short lead to the case in three or four places about the receiver board. Using threaded metal standoffs and solder lugs allows for both good mechanical and good electrical mounting. One rig built exhibited self-oscillation before it was grounded to the case in this fashion.



Inside view of transceiver. Visible are transmitter (above), receiver (below), dynamic microphone, T-R switch on side of case, batteries in plastic holders, and removable telescoping antenna.

Once tuned up and mounted in a metal box, the receiver is stable and unaffected by hand capacitance. Its characteristic of low hiss noise with no signal input eliminates the need for a squelch. Its small size and low price ($11) make it an excellent find for the VHF builder and experimenter.

Assembly

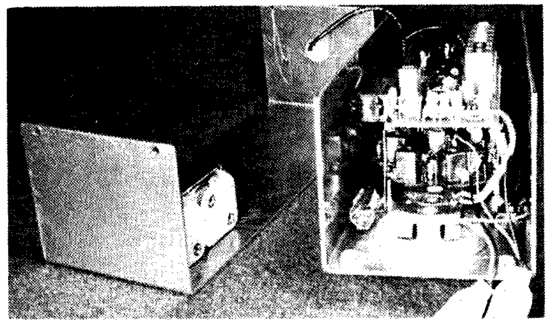
A simple, sturdy case for the transceiver was made by folding 1/16" aluminum into two "U" shaped pieces that fit together as shown. Everything except the antenna and battery clips is mounted in the front half of the case. The case shown measures 22.5 x 8 x 7 centimeters, but as you can see there is still a bit of room left inside.

A more compact design with perhaps a different battery arrangement might yield a more pocketable transceiver. You might have an old CB type talkie gathering dust somewhere from which you could steal a case. Be sure to disguise it so it won't look CB.

A nice stainless steel appearing finish can be had on aluminum by rubbing it in long, straight strokes with steel wool. The steel wool wears out (and so does your arm), so stop occasionally and rub in some light oil. The resulting finish is well worth the hard work. Deep scratches in aluminum are difficult if not impossible to rub out. Protect the new metal surface before bending and drilling by spraying on several coats of enamel.

Acetone will quickly remove the paint after it has served its purpose.

T-R switching is complicated somewhat by the different polarity of ground in the transmitter and receiver. A six pole double throw switch was employed, with two sections paralleled for antenna switching. The antenna that comes with the receiver is just the right length for two meters. Solder it to the center pin of a BNC connector and stand it perfectly upright in your oven. Mix and pour epoxy cement into the BNC and leave it overnight at 150-200F (this is the ONLY way I've been able to make those dime-store epoxys set).



End view showing how receiver and transmitter are stacked.

The speaker, perforated metal grille, and a thick sheet of polyethylene were sandwiched together and epoxied to the case behind an appropriately sized punch-hole. Epoxy, when applied to clean, roughened surfaces and hardened at an elevated temperature is sufficiently strong for construction of this sort. It eliminated a number of screws and clamps that would otherwise have been needed to mount the mike and speaker, detracting from the appearance of the finished rig.

Speaking of helpful hints, you can prevent the wires from breaking off inside those snap-type battery clips by squirting vinyl cement into them and letting that harden up. Eight zinc-carbon AA cells in two standard holders are used with my transceiver. If you want to buy nicads or alkaline cells, then you should plan on using 10 due to their lower voltage under load. Carbon cells are most economical and last through six or seven rechargings. The assymetric ac charger described in 73 (4) has been used around this shack for charging all kinds of batteries with excellent results.

The walkie-talkie works well too, and makes for a quick and easy portable for the OT repeater-blipper, or an inexpensive introduction to Fun Mode for the newcomer.

. . . WA5RON

References

(1)VHF Engineering 320 Water St. PO Box 1921, Binghamton, NY 13902.

(2) Olson Electronics 260 S. Forge St., Akron, OH 44327.

(3) Articles concerning two meter receiver preamplifiers have appeared in 73 Magazine in the following issues: (Month Year Page) JUL 67, 48; OCT 68, 112; JUN 69, 76; MAY 70, 74; FEB 72, 97; MAR 72, 112; NOV 72, 120; DEC 72, 23; DEC 72, 134; APR 73, 27; APR 73, 93.

(4) Reverse-Current Charging (K8YUC in 73, March 1970, page 20).

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Proof of the Extraterrestrial Repeater

Throughout the history of electronics amateur radio has helped to explain and understand the phenomenon of radio. Hertz, Marconi, and Lee De Forest were all pioneers in radio communications and were in many ways true examples of amateur radio operators exploring the unknown. Now, amateur radio has shown that intelligent extraterrestrial life has visited the vicinity of earth.

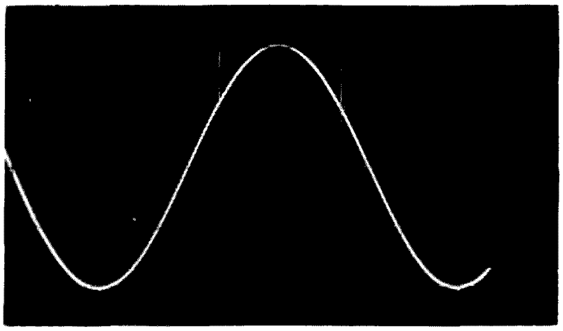
In experiments conducted over a period of years, it has been demonstrated that natural causes are not the only reflector of radio waves over the earth. A system of alien repeater satellites relays radio signals around the earth and to a distant planet in the constellation Bootes (Balfour, Malcolm, "Scientists Attempting Contact With Alien Space Probe Believed to be Orbiting Earth," *National Enquirer,* Vol. 47, No. 29, March 18, 1973, p. 26).

These satellites derive their power from the sun's energy and especially the higher forms of energy present during periods of high sunspot activity. These repeaters work continuously but are much more active during peaks of the eleven year sunspot cycle, thus making it appear that all skip activity is natural in origin.

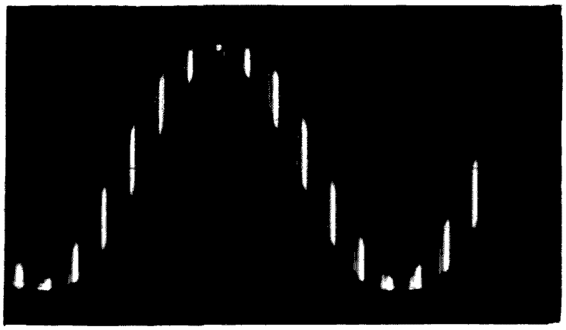
The proof was determined after careful research into pulse and multiplex transmission methods. Close experimental observation of the received waveform on 40 meter signals showed that many of them were segmented. Many CW signals would appear to be noisy on the oscilloscope, but after close inspection the signal was actually being pulsed on and off very rapidly. The pulses were so rapid that the ear could not hear them and after detection and audio amplification no distortion was present in the speaker output.

My Heathkit IO-103 scope has a maximum response to ten megahertz so all observations were done on 40 and 80 meters initially. Later a series of low noise very low distortion converters were built for the higher bands and all bands showed signs of the segmented signals.

As can be clearly seen from the example, the DX stations signal was being turned on and off very rapidly. At first it was a puzzle to understand what could cause such a signal, but later it was easily explained. The only answer that could fit all the available facts is the idea of a phantom repeater in outer space. The repeater would receive the original signal, store it in a temporary memory device, retransmit it an instant later on the same frequency, and then go back to



Normal 7 MHz sine wave as received without the phantom repeater operating.



A signal that has been retransmitted through the phantom repeater.

the receive mode to pick up the next segment. It works very much like break-in CW but much faster.

This effect can be only seen before any mixing is done in the receiver. The output waveform of the signal must be seen just after the first radio frequency amplifier stage, and, if it was possible, directly out of the antenna would be best. The scope was attached to the plate output of the first rf amplifier of my transceiver and a high gain wide band preamplifier was added to increase the sensitivity of the scope.

It can be seen that the change from receive to transmit is nearly instantaneous and very many repeater cycles can be seen on each Hertz of received signal. After the first mixer stage very poor results are obtained because of distortion and non-linear amplification in these stages; also the capacitors and inductors used as LC circuit elements tend to average out the individual repeater cycles due to their charging effect.

This discovery offers many answers to numerous and as yet unexplainable radio observations. The most obvious is the much publicized L.D.E. (Long Delayed Echo). (Villard, O.G. Jr., "Long-Delayed Echoes – Radio's 'Flying Saucer' Effect," *QST*, Vol. LIII, No. 5, May, 1969, pp. 38-43.) These L.D.E.s occur very infrequently and only under very special circumstances (Villard, O.G. Jr., "A Long-Delayed Echo $\overline{\text{AR}}$," *QST*, Vol. LIV, No. 2, February, 1970, p. 33). It is easy now to explain them as a simple malfunction in the alien repeater or perhaps replays of some special signal that the central control wanted to hear again.

If a careful analysis of the pattern to the L.D.E.s can be made it may even be possible to communicate directly with the alien central control by knowing what conditions they watch for when asking for a replay of a transmission.

It is also probable that more than one system of satellites are listening to earth. The short term L.D.E. (two or three seconds) is probably caused by a second relay system in the orbit of the moon. This short term L.D.E. is most common on 80 meters and is presently being actively investigated (Villard, O.G. Jr., "A Long-Delayed Echo $\overline{\text{AR}}$," *QST*, Vol. LIV, No. 2, February, 1970, p. 33). The time delay from the earth to the moon round trip is about three seconds. This time delay would be about correct for the secondary repeater system.

This initial satellite system is a near earth Stationary Orbital System (SOS). It consists of three or four satellites that relay all types of radio transmissions to other parts of the earth and to the alien central control in the star system of Bootes. The Lunar Orbital Satellite System (LOSS) was installed later and probably works in the three or four MHz frequency spectrum exclusively.

A system such as SOS can explain much of the abnormal DX activity that goes on in the amateur bands. How many times have amateurs heard signals on the air that just should not be there? Japan and Europe can come in well at the same time and at a time when the charts say that it is impossible to hear either one. It is easy to understand this abnormal activity now that the SOS and LOSS systems have been discovered.

The most pressing issue is what we as amateurs can do about these super "Watergaters" in the sky. First, all transmissions derogatory to aliens must be banned. We do not know what they may look like so all talk of little green men or bug-eyed monsters should halt. Second, an attempt should be made to analyze these relay satellites. Find out from the earth what makes their control system work and perhaps take control of their functions. It would be then possible to concentrate their energy in smaller segments of frequency and have good DX all year long.

Of course the deflector shields and anti-jamming equipment must be overcome first. Possible defensive weapons such as photon torpedoes and phaser rays may deter NASA from looking at these satellites too closely, but with telescopes it may be possible, once the space shuttle starts regular operations, to see them from outer space directly.

The use of the SOS and LOSS system may be the next great advancement for radio since the discovery of short waves. If reliable worldwide communications without fading at all times could be achieved, it would be the greatest discovery in recent history for the radio amateur.

...WB6IQS

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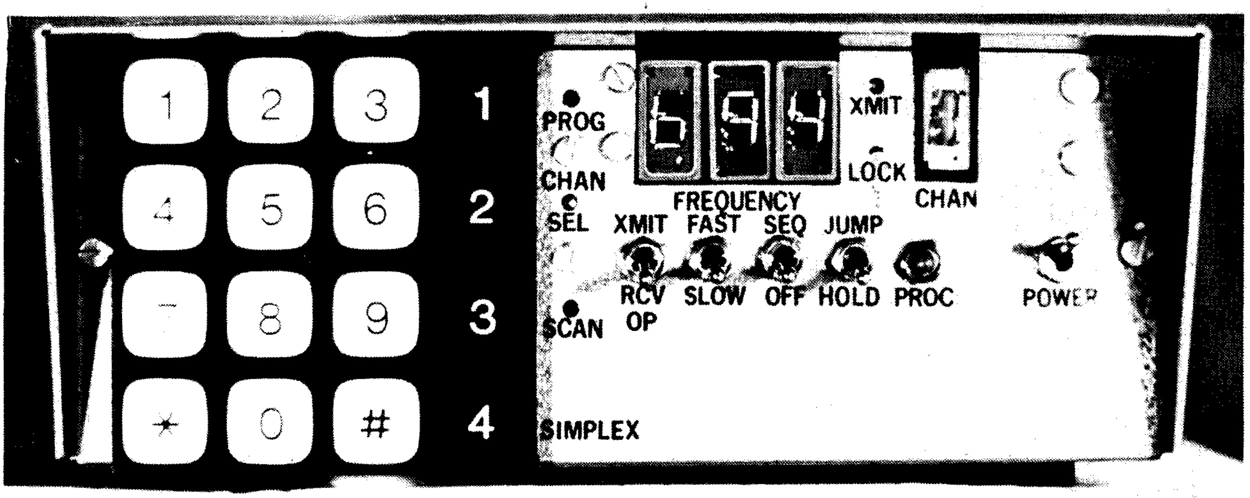

Front panel view of the scanner showing Channel 1 containing the frequency 6.94 (146.94). Channel select mode is indicated by one LED and the lock indicator LED is also visible. Photographs by K4CHS/Ø.

Scanning With a Synthesizer

When first getting on 2m, in a somewhat typical fashion with a commercial crystalled transceiver, I began thinking of a possible next step in upgrading the station. At this point I seemed to hit a dividing point: I could either buy or build a scanning receiver so I could keep up with activity on the different frequencies – thereby being bound to the crystal market – or I could go the synthesizer route. The synthesizer seemed the more versatile way, so I incorporated a GLB 400B Channelizer in my station. Since, however, I would lose the benefits of scanning, it seemed logical to combine the advantages of both, hence, a scanning synthesizer.

To allow for easy reprogramming, I chose a Random Access Memory (RAM) as the basis for the scanner. The net result is a scanner which stores eight pairs (transmit and receive) of frequencies, and of these eight pairs, selected receive frequencies can be scanned. Provision is also made for one of the eight pairs to automatically be incremented in 10kHz steps over a one MHz segment to effectively sweep a selected MHz. The frequencies are entered into the RAM from a touch pad. Three digits of 7-segment readouts display the receive and transmit frequency appropriately, and a single 7-segment display shows the channel number. The scanner can also recall a specific frequency at a touch of a single button. A feature to make operation convenient permits the transceiver's PTT button to stop the scan, and, in addition, a jump option provides a pseudo-priority type operation.

As for the important statistics, the

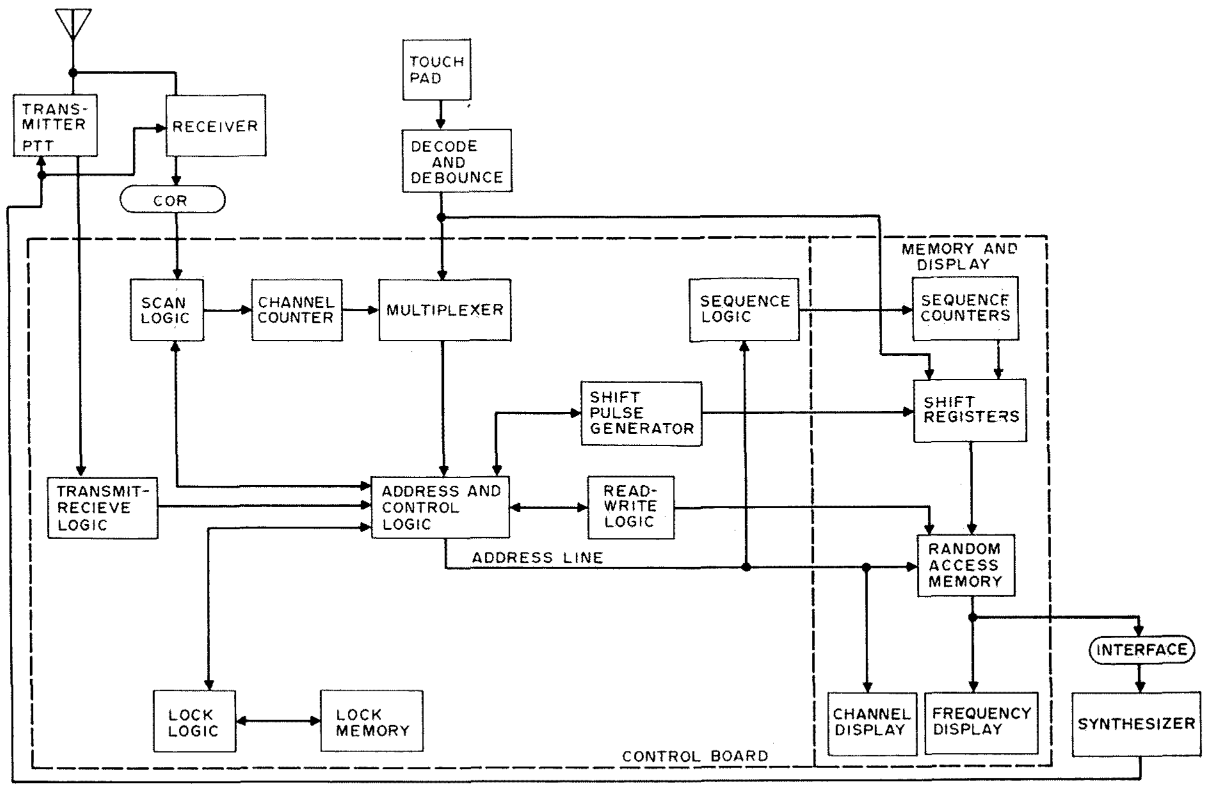

Fig. 1. Block diagram of the scanner in a two-meter station.

scanner uses approximately $40 worth of ICs. The touch pad and four 7-segment displays are the only other parts that hurt the pocketbook and are not as likely to be in the standard junkbox. The touch pad costs about $8. The entire circuit operates on 5V, but a power supply of two LM309K regulators makes it easily used with 12V.

Theory of Operation

Although the overall schematics are somewhat foreboding with 41 ICs, the functions can actually be separated into 17 blocks and built on four boards. The scanner is represented in the block diagram, Fig. 1. The key elements of the scanner are the shift register and memory blocks. The remaining circuitry effects control of those blocks or accomplishes special functions. Before reading the theory of operation, I would recommend reviewing the section on operation.

Memory and Display Board

Let's start with the memory and display circuitry which is represented on the block diagram enclosed in a dashed line. ICs16, 17, 18, Fig. 2, are 4 bit, parallel-in, parallel-out shift registers which allow for data manipulation and entry from both keyboard and sequence counter (ICs14, 15). The sequence counter is a Binary Coded Decimal (BCD) divide-by-ten counter that counts from 00-99. If the sequence circuit is on, each time channel 7 is scanned, the counters are incremented, and their outputs are gated into the shift registers (ICs16, 17) by a pulse called Sequence Pulse (SP). A Read Enable Low-digit pulse (REL) transfers the count from the shift registers to the memory (ICs11, 12). The shift function of the shift registers is used for a touch pad entry. When programming the memory, the touch pad BCD digit is gated into the MHz digit shift register (IC18) with the New Word Pulse (NWP). After the NWP, the control logic on the control board supplies a shift-register Mode Control pulse (MC) and a series of four shift pulses called Clock 1 Pulses (C1P). The result is a rotation of four bits (or one BCD character) in the shift registers (ICs16, 17, 18). This causes the BCD character just entered in the MHz position to appear in the 10kHz position and moves the contents of the 10kHz to the 100kHz position, etc.

Therefore, as each character is keyed in,

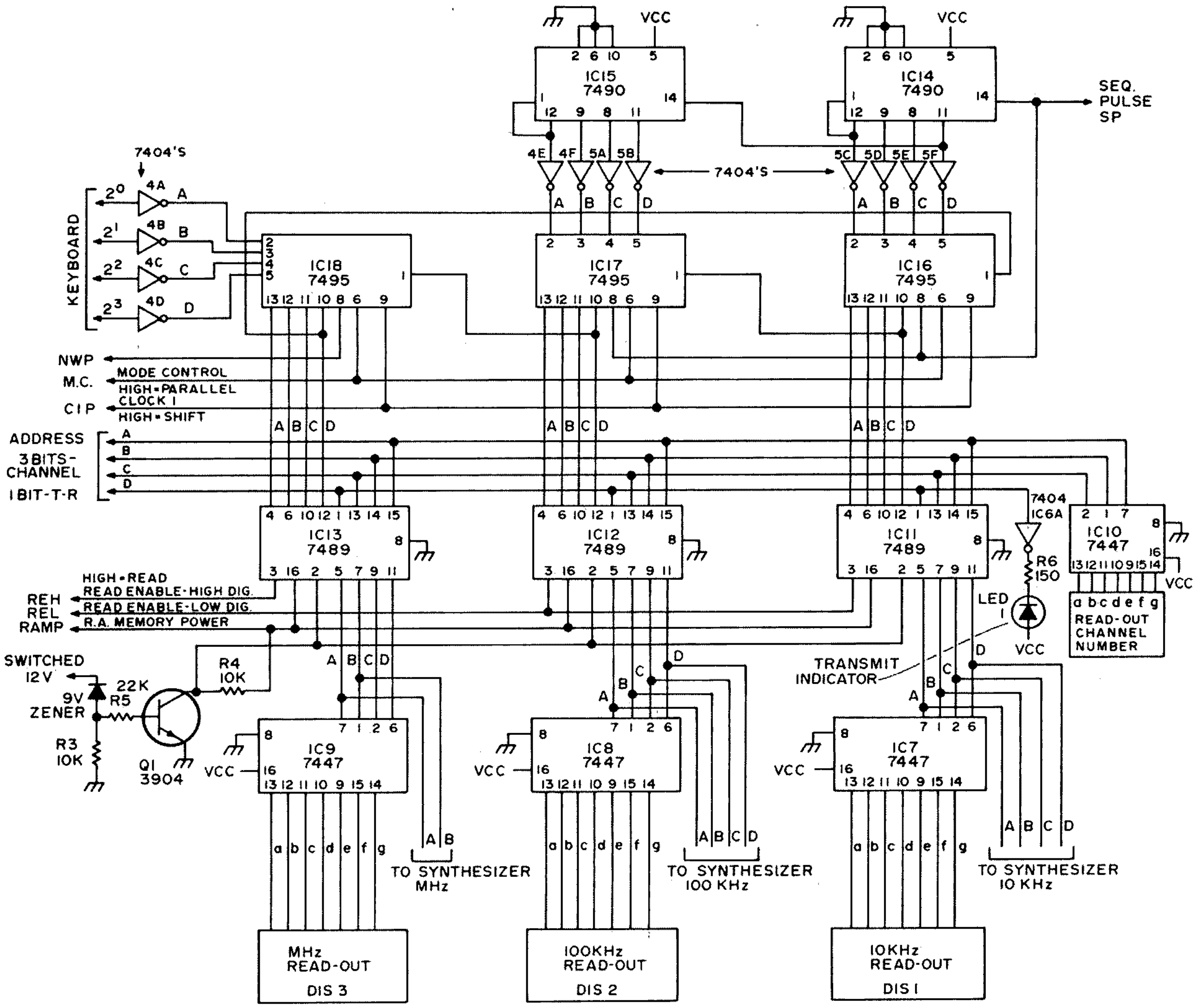

Fig. 2. Schematic of the memory and display board.

it appears on the right; old characters move to the left. For example, if the frequency display reads "069" and a "4" is keyed in, the BCD representation of 4 (0100) enters the MHz position shift register (IC18), and 4 pulses rotate the contents of the shift register by four bits. The frequency display now reads "694."

After the data are rotated in the shift register, they are stored in the Random Access Memory (RAM-ICs11, 12, 13) by the read enable pulses (REL, REH). Each RAM stores 64 bits, which makes it convenient to store 16 BCD characters, or eight transmit-receive pairs. The address in the RAMs is four bits. Of these three bits are the channel number in binary (000-111); which is decoded by IC10 and displayed as the channel number. The other bit of the address is low for receive and high for transmit and is supplied by the transmit-receive section of the control logic. A Light Emitting Diode (LED 1) is driven by an inverter IC6A and serves as the transmit indicator, i.e., displays the status of the fourth address bit.

Memory output in BCD sets the synthesizer frequency and drives the 7-segment decoders (IC7, 8, 9) for frequency readout. Therefore, what the displays show and what goes to the synthesizer is always identical. What you see is what you get. Reviewing the address for each RAM (address lines ABCD, Fig. 2) is four binary bits; three bits are the channel number in BCD (0-7) and one bit is the transmit-receive status.

If power to the RAMs is lost, the information stored will be lost. Rather than have the entire unit on all the time, I used a separate unswitched power supply for the RAMs. However, when the rest of the circuit is switched, transients occur in the control

lines for the RAMs. A circuit of ZD and Q1 (Fig. 2) disables the RAMS when the power to the other circuit is turned off by ungrounding the chip-enable pin of the RAMs.

Decode and Debounce

The decode and debounce board is straightforward and consists of a diode matrix and the new word pulse generator (Fig. 4). This is designed for a Chromerics touch pad which gives a low state on the terminal corresponding to the button pushed. The diode matrix (D1-15) decodes 10 lines to 4 BCD keyboard outputs. When a character is entered, a pulse on any BCD line or from the zero button initiates a New Word Pulse (NWP). The signal from IC2A fires a dual retriggerable monostable (IC3) which generates the actual NWP signal. A gate (IC2B) permits this pulse to pass only if the key is still depressed, which insures that the key depressed for at least the length of time that the first section of the dual monostable fires. The capacitance of C1 can be increased to lengthen the delay of the first monostable if any bounce problems occur. The NWP communicates to both the control board and the memory and display board that a new digit has been entered from the keyboard.

Control Board

The control board (Fig. 1, Fig. 3) is the brains of the scanner. Refer to the block diagram (Fig. 1) for the component elements. First, a few general comments: All gates are 7400 series NAND gates with either 2, 3 or 4 inputs or inverters. The NAND gates can be thought of as performing three functions. First, they can operate in a logical AND function with an inverted output (as when both inputs go HIGH the output goes LOW). Secondly, they can operate as a logical OR function with inverted inputs (when either input goes LOW, the output goes HIGH). Thirdly, they can be used as inverters whenever convenient.

The primary purpose of the control circuitry is simply to provide a four bit address to the memory circuit. It also provides shift-register control pulses (C1P, MC), a Sequence Pulse (SP) to increment the sequence counter, and finally read-enable pulses (REH, REL) to the memory.

Address Logic

The address is made up of four bits. One

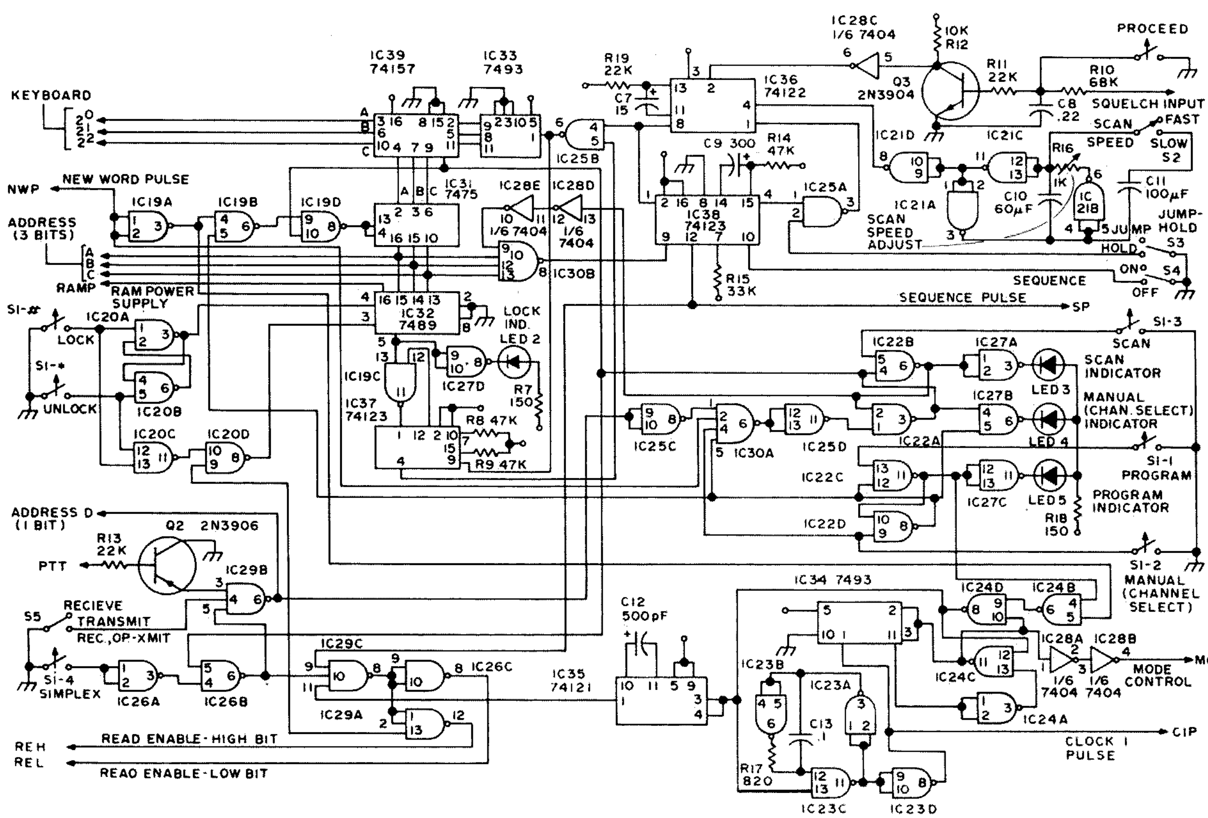

Fig. 3. Schematic of the control logic board.

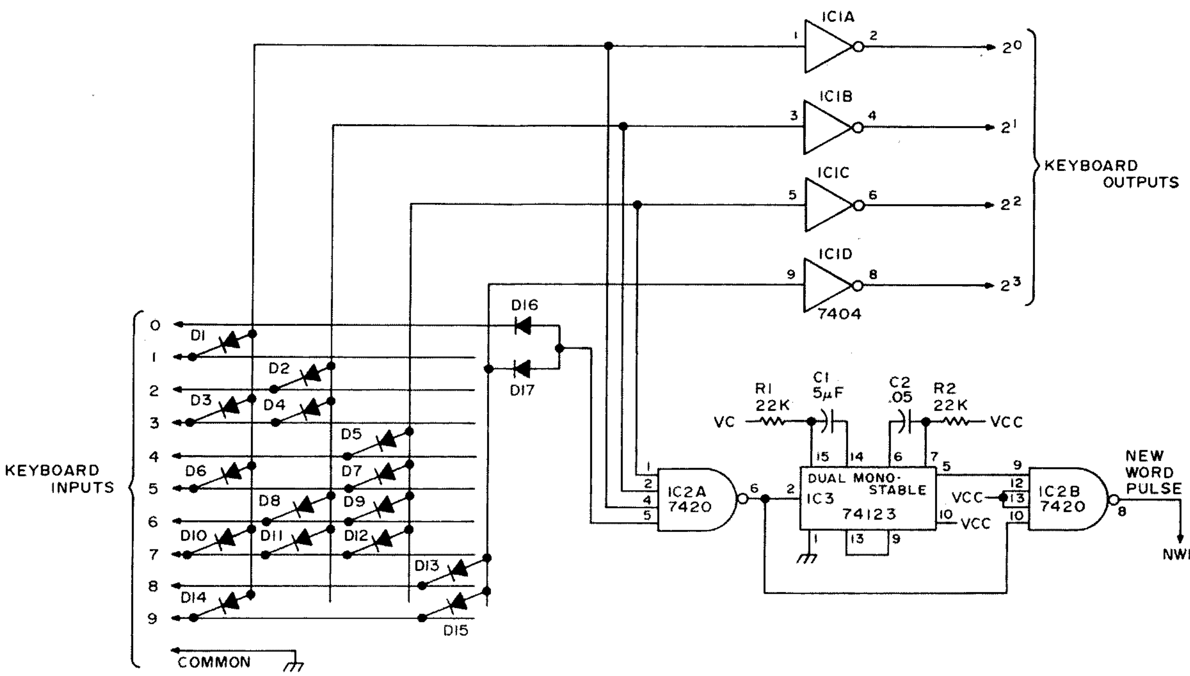

Fig. 4. Schematic of the decode and debounce board.

bit is the transmit-receive status; three bits make the channel number (0-7) in binary (000-111). The three bits of address information come from one of two sources, the keyboard or the channel counter (IC33), and go to IC39 which is a multiplexer. The multiplexer can be considered as a three-pole double-throw switch connecting its outputs – pins 4, 7, 9 – to either set of inputs as controlled by the level on pin 1; HIGH indicates channel-select mode (keyboard input) and, LOW, scan mode (channel counter input). The output of IC39 goes to IC31, which is a latch. The latch stores data when the input control (pins 4, 13) is LOW, and it transfers data on input control HIGH. When in the scan mode, no storage is necessary, so IC19D holds pins 4, 13 HIGH in scan mode since IC 19D-10 is LOW in scan mode, forcing its output HIGH. However, when a keyboard entry is made in channel select mode, storage of that information is required and accomplished by using the NWP to gate the data into the latch. When a keyboard entry is made, the NWP is inverted by IC19A. IC19B gates the inverted NWP through when in channel select mode. Hence, the NWP can serve as the clock pulse for the latch to store the keyboard entry. IC19B inhibits in program mode; therefore, the latch stores or transfers the appropriate channel information which is three binary bits of the four bit address used for the RAMs.

Scan Logic

The scan logic includes the channel counter (IC33, Fig. 3) which is used as a ÷8 counter and generates the channel number when scanning. The scanning rate is determined by the oscillator consisting of IC21, C10, C11 and R16. The slow scan switch adds extra capacitance to slow down the oscillator. Capacitors C10, C11 can be changed to suit the builder. Pulses from the oscillator trigger a monostable (IC36). The monostable generates a relatively wide pulse of about 100ms when it is not inhibited by the signal from the receiver squelch. The input from the receiver squelch is filtered by R10, R11 and C8 and buffered by Q3 so that IC28C-6 is HIGH for signal, LOW for no signal. If a TTL compatible squelch circuit is used, the filter and buffer can be eliminated. The output of monostable IC36 is gated by IC25B advancing the channel counter (IC33).

Jump-Hold Logic

One half of IC38 is another monostable and is kept retriggered by the scan pulses from IC36-8. If, however, the squelch opens,

IC36 is inhibited and IC38 is not retriggered, so that after its time constant (approximately 5s) its output, pin 4, goes back to HIGH. If the jump-hold switch (S3) is in the jump position, then the output of IC25A goes LOW, enabling IC36. This, of course, resets IC38 again and the cycle starts all over.

Mode Control

The mode of the scanner is primarily controlled by three switches which are part of the touch pad. These are the fourth column digits ①, ②, ③, which are Program, Channel Select, and Scan, respectively. The switches control the two set-reset latches (IC22). IC22B-6 is HIGH in scan mode. IC22C-11 is HIGH in program mode. When both aforesaid lines are LOW, the channel-select mode is achieved. The output states of these latches are displayed by LEDs 3, 4, 5. Note that only one current-limiting resistor, R18, is needed, since the latches are interlocked.

While three of the four inputs to the latches are switch contacts, the reset to the scan latch (IC22A-1) includes a four input gate IC30A. This performs a logical OR function allowing any of the four signals to reset the latch. Pin 1 is low in transmit to stop the scan when the Push to Talk (PTT) is activated. Pin 2 is low during a NWP, so if a touch pad channel is keyed in, the scanner will revert to channel select mode. Pin 4 is the channel select switch (S1-②). Pin 5 is LOW in program mode to form the interlock between the latches. Several other lines go from the output of these latches to the remainder of the circuitry and accomplish mode control.

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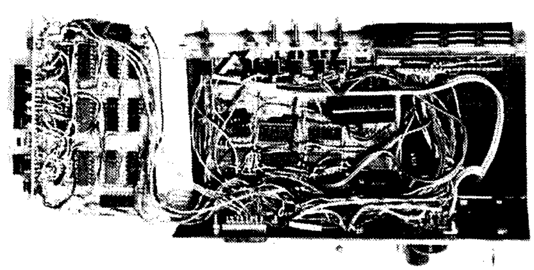


Cover off view of the scanner with the memory and display board removed to show the control board below.

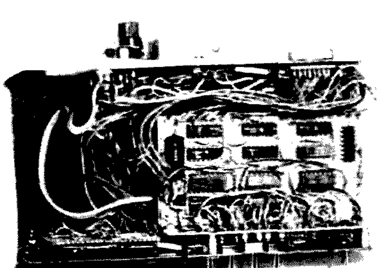
Shift Pulse Generator

The block shown as shift pulse generator on the block diagram (Fig. 1) is IC23 (Fig. 3) which is controlled by IC24 and IC34. IC23 forms an oscillator which runs when IC23C-13 is HIGH. It is necessary to remember that the shift registers need four pulses to shift the digit one place when a digit is entered in program mode. If a keyboard entry is made in program mode, IC24B gates the inverted NWP to IC24D. This sets a latch (IC24C, 24D). As this latch is set, it resets IC34 which is used as a divide by four counter and also starts the oscillator (IC23). The oscillator output is the Clock 1 Pulse train (C1P) and is counted by IC34. When the counter reaches "4," pin 11 goes HIGH, which, by way of IC24A, resets the latch and stops the oscillator. The net result produces a pulse train of four pulses which is called C1P.

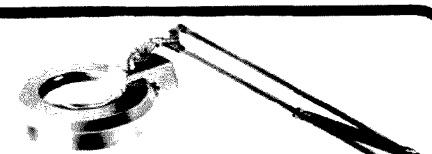
An output from the latch also controls the mode of the shift registers, since they can operate in either parallel or series. To prevent a timing problem a pair of inverters (IC28A, 28B) provides a delay before changing the Mode Control (MC) line (HIGH to LOW) from parallel to series. After the pulse train is completed and the latch resets, the monostable (IC35) fires, giving a short pulse to the read-write logic and the new digit is written into the memory.

Transmit-Receive Logic

The PTT signal (LOW for transmit) enters through R13 to Q2 which serves as a buffer to the TTL logic. IC29B generates the transmit-receive status bit which makes up one bit of the memory address (LOW for



Cover off view of the scanner with all boards in place. Note the top edge of the decode and debounce board is visible behind the touch pad. This is attached directly to the pad with Molex pins.



receive and high for transmit). The three inputs into the gate (IC29B) allow three signals to force the bit HIGH for transmit. Pin 3 from the PTT line, pin 4 from the receive and operate--transmit switch (S5), and the simplex signal from IC26B-6 will force the address bit high.

The simplex function (S1-④) copies the information that was entered in receive into the transmit memory. When (S1-④) is pressed, it activates two functions: First, it changes the receive-transmit status, to transmit, and secondly, it gives the read-wire logic a signal (IC29C). IC26B is used to inhibit simplex operation in scan mode to prevent overwriting the memory by accidently hitting the simplex button.

Read-Write Logic

The read-write control is made of three gates (ICs29C, 29A, 26C). The first, IC29C, logically ORs the three conditions that require the memory to be put in the write mode. These are: the write pulse for the sequencer operation that goes to pin 9, the write signal for simplex operation from IC26B, and the write pulse for a new entry from monostable IC35. For both simplex and a new entry, each of the memories needs a write pulse, but from the sequencer only the lower order two memories are changed, so IC29A inhibits the write pulse for the high order (MHz) digit memory in scan mode. Although I speak of write pulses, the RAMs are controlled by read-enable lines. These write pulses are LOW to write and HIGH to enable the memories to read. The line to the HIGH order (MHz) digit is called Read Enable HIGH (REH) and the line to the LOW order two RAMs is called Read Enable LOW (REL).

The Sequencer

The sequencer utilizes IC30B, IC28E, IC28D, and one half of IC38. This circuit generates a Sequence Pulse (SP) to increment the sequence counters (IC14, 15) and to give the low order two memories a write pulse. When the sequencer is on (S4), monostable IC38 is enabled. IC30B detects the channel number "7" by looking for all HIGH levels on the address lines. This then fires the monostable IC38. IC30B is enabled only in the scan mode through the pair of inverters IC29D and IC28E. This pair of inverters is required for the special case when the scanner is in channel-select mode and on channel 7 and then is switched to scan mode. Without the delay, a sequence pulse would be generated and take place after the address is changed.

Lock Logic and Lock Memory

The last blocks are the lock logic and memory. The lock data are entered from switches S1-# and S1-*. These signals set and reset the latch made from gates IC20A and IC20B. IC20C logically ORs both switch inputs to create a write pulse for the lock memory. IC20D inhibits the write pulse during scan operation. The output of the latch provides the data for the memory and the output of IC20D generates the write pulse. The lock memory (IC32) gets its address from the three channel number bits, as do the other RAMs, but the receive-transmit bit is not needed, since only 8 bits of data are stored. The output of the RAM, pin 5, basically does two things: First, it supplies the signal for IC27D which drives LED 2 and indicates the lock status of the channel. Secondly data also are gated through IC19C to fire one half of monostable IC37. This pulse is only about 300 ns wide and through gate IC25B advances the channel counter (IC33). Hence, a locked channel is rapidly skipped. However, if two locked channels in a row occur, the monostable would not give an additional pulse, so a second monostable (the other one half of IC37) is fired by the first and interrupts the data from the memory with gate IC19C. This allows multiple locked channels to be skipped in less than one microsecond per channel. Well, that's it! Simple enough?

Construction

The builder can have much flexibility in layout and construction of this project. At this time, printed circuit boards are not available, so I will make some general comments about the methods I found useful.

Layout is noncritical. Adequate bypassing of the ICs is essential. I can't emphasize this

point too much. Each monostable and counter should have its own .01μF capacitor across its power leads. These are not shown in the schematics. I also put an electrolytic on each board, something in the 100-300 μF range. With these precautions, I experienced no difficulties with transients. There are many fast pulses in close proximity, so do use the .01μF capacitors very liberally.

I used microvector board wiring on both sides, but wirewrap would also be a good method if the equipment is available.

Decode and Debounce

I divided the circuit into four major boards. The decode and debounce board is small, 5.72cmW x 6.03cmH (2-1/4"W x 2-3/8"H), by using Molex pins on the board. It plugs directly onto the Chormeric pad, thereby eliminating interconnections. The pad is a 4 x 4 touch pad with 16 output lines plus a common and can be purchased from B&F Enterprises as well as other sources. The dimensions are 7.62cm x 7.62cm (3" x 3") Refer to Fig. 5, for the pin diagram. On

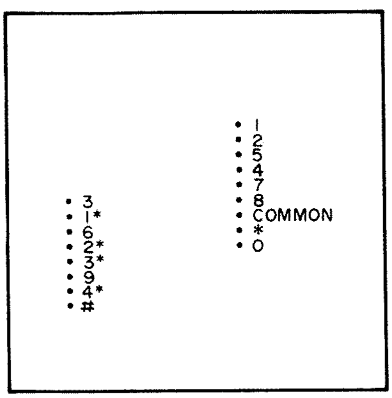


Fig. 5. Diagram of the pin connections of the Chromerics touch pad.

an earlier prototype I employed a standard Touch-Tone keyboard using the switch contacts only, but a different decoder has to be used to convert its 3 x 4 matrix output to Binary Coded Decimal (BCD), and four additional push buttons are needed to replace the extra four buttons on the 4 x 4 Chromerics pad.

Memory and Display

The second major board, the memory and display board, is straightforward. Again, don't forget to bypass. I recommend bypassing all the chips on this board. The layout is primarily just BCD lines in parallel for the data and address information as in the schematic. When making this, lay out the board in such a way that the 7-segment readouts can be mounted on the panel. I used a 11.43cm wide by 6.03cm deep (4-1/2" by 2-3/8") microvector board with a 11.43cm by 2.54cm (4-1/2" by 1") board placed at a right angle to mount the 7-segment displays. Put a 500 μF capacitor on the memory power supply (RAMP) line to decrease transients associated with turn-on.

Control Logic

The control logic fits on a 4.43cm wide by 9.84cm deep (4-1/2" by 3-7/8") board. There are no major considerations except to again bypass the ICs. When laying this out, allow for the larger capacitors used with the monostables, IC38, and with the oscillator IC21. Throughout, it may be easier to build segments of the circuit and test them before assembling the entire unit. Observe that the fourth column buttons of the touch pad are denoted as S1 followed by circled numerals indicating the row.

Interface Board

The final board is the interface board (Fig. 6). This is very small and can be mounted inside the synthesizer with S7 mounted on the panel. I mounted a 15 pin connector on the synthesizer so it could be easily disconnected and used alone.

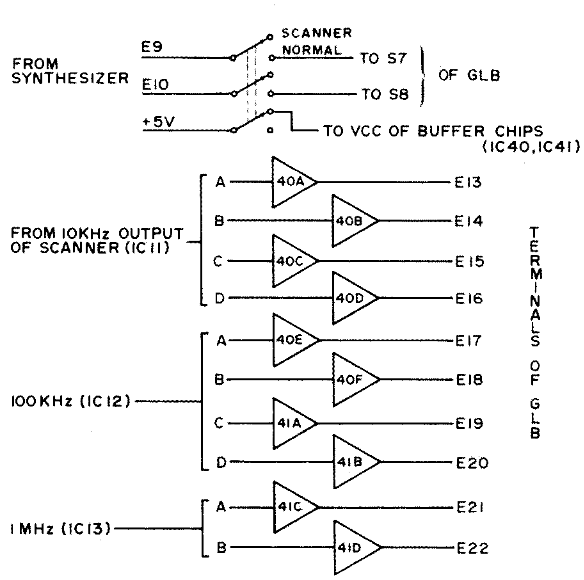


Fig. 6. Schematic of the interface between the scanner and a GLB 400B Channelizer.

Power Supply

The power supply (Fig. 7) is just two 309K 5V regulators. One is switched from the panel (S6), and the other is unswitched to supply the memory chips which will lose

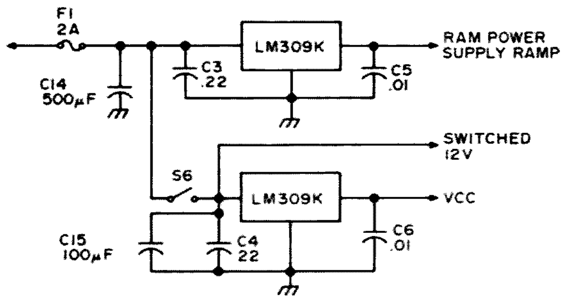


Fig. 7. Schematic of the 5V power supply.

their data if power is interrupted. Don't omit C15, Fig. 7, as this is necessary for the memory protect circuit.

The entire unit fits into a 7.62cm x 20.32cm x 12.7cm (3" x 8" x 5") cowled minibox if not too much room is wasted. A 15 pin connector is good to allow for interconnections with the synthesizer. In making interconnections between boards, be sure to allow for slack to lift out each board.

Interface

The scanner was designed to interface with the GLB 400B Channelizer. Since the scanner basically replaces the frequency-select switches of the synthesizer and these work at digital logic levels, there is no problem with the interface. Hex buffers are used as shown in Fig. 6. In addition to providing a buffering action, these serve as diodes to isolate the scanner from the synthesizer's own switches when the hex buffers are turned off. Therefore, the synthesizer can be controlled with its front panel switches independently of the scanner.

Though I have not used it with any other synthesizer, a similar interface could be devised, if switches are digital, with either buffers or inverters to obtain the proper BCD levels; if a 10 line switch is used, 4-10 line decoders could replace the buffers. The primary limitation would be the lockup time of the synthesizer. The GLB is rated at 10-20 ms typical, 100 ms maximum lockup time. The scan rate would have to be decreased with slower lockup times of some other synthesizers.

I will say least about the receiver interface as this will vary much with different transceivers. If used with some commercial ones, the auxiliary squelch line may work directly. The scanner requires a high level when there is no carrier and ground when carrier is present. The scanner has a transistor buffer, so the signal from the squelch does not need to be TTL compatible. Many COR-type circuits have been published and will be satisfactory for the squelch input.

Operation

There are three basic independent modes of operation: (1) Program (2) Channel Select (3) Scan. These modes are selected by switches on the pad, and their status indicated by the adjacent LED indicators.

In program mode, the touch pad functions as a means of entering data into the RAM memory. As a number is keyed in, the new number appears on the display in the right-hand position. The numbers that were there previously appear to shift to the left; therefore, if a mistake is made upon entering, the correct number can be re-keyed in and stored. If a simplex pair of frequencies is desired, it is necessary to key the number into the receive frequency; then touching the simplex key will store the number in the transmit location. If a duplex pair, however, is to be programmed, then the transmit-receive and operate switch is moved to transmit position, and the transmit frequency is entered in a similar manner. This switch is left in the receive and operate position except when programming a transmit frequency, or if it is desired to view the transmit frequency without actually keying the transmitter. The channel remains unchanged in the program mode.

The channel-select mode allows the touch pad to select the channel, which is associated with a paired frequency. The channels are designated by channel numbers 0-7 and displayed on the panel as Channel, with a 7-segment readout. If the operator desires to monitor or use a pre-programmed frequency, he need touch only the proper channel number on the pad and the already-stored

frequency will be displayed.

The final mode is the scan mode. In this, the scanner advances through the selected channels; as a carrier is detected, the scan will stop on that frequency for either a 5 second period of time (if the jump-hold switch is in the jump position) or will remain until the carrier is dropped (if that switch is in the hold position). The advantage of the jump position is that, if you desire to listen for a station on another frequency which may not be the common-call frequency, a long-talking station won't keep you from missing the other call. If the transmitter is keyed in scan mode, the channel remains unchanged, and the mode is automatically returned to channel select – thereby preventing it from continuing to scan when the carrier is dropped. This makes answering a call on any active frequency as simple as briefly keying the transmitter, assuming you have programmed in the proper associated transmit frequency. To return to scan mode, just press the scan key. Also, if you wish to go to a specific channel, just press the touch key of the channel number and the scanner will automatically revert to the channel select mode and display the keyed-in channel and corresponding frequency. A fast and slow scan switch allows the rate to be reduced to a speed the eye can follow to inspect the frequencies being scanned. A proceed button enables the operator to continue the scan if it is stopped on a channel. When used with the GLB 400B Channelizer, I have found that a scan rate of about 10 channels per second can be achieved, so if, for example, 5 of the 8 channels are selected to be scanned, each channel is checked two times a second.

Other features include the ability to "lockout" a channel. This is the method that allows only selected channels to be scanned. When a channel is locked out, it will be skipped when scanning. The lock indicator LED lights when a channel is locked. For example, if channels 1, 4 5 and 7 are locked out, the scan will look at channels 0, 2, 3 and 6. To lock out a channel, the "lock" touch key (the #) is pressed when in either program or channel-select mode, and the lock indicator LED will light; to unlock a channel, similarly, the unlock button is keyed (the *). When no channels are locked out, all eight channels are scanned, and up to 7 channels can be locked out – a useful situation when using the sequencer.

What is the sequencer? Well, this is the function that will sweep in 10kHz steps, a selected MHz. When the sequencer is switched on, Channel 7 becomes a special channel. Only the data in the MHz position remains unchanged, and the 100kHz and 10kHz positions are sequentially incremented by 10kHz each time that Channel 7 is scanned. In other words, each time the channel is "looked at," the receive frequency is increased by 10kHz. If all the channels except this one are locked out, then it is repeatedly scanned. At 10 channels per second, if only Channel 7 is being scanned, you can check a 1MHz segment for activity in about 10 seconds; if all 8 channels are being scanned, the 1MHz is covered about every 80 seconds. When the sequencer is switched off, Channel 7 behaves the same as all the other channels and can be scanned without its contents being changed.

Although on first reading this may seem very complex, the important point in operation is that of the three modes of operation – Program, Channel Select and Scan – it can be in only one mode at a time. To put frequencies in the memory, put it in program mode and the touch pad enters frequencies. In channel select mode the touch pad serves to enter the channel number. To scan, push the scan button and it will check all the channels for activity that are not locked. The lock and unlock buttons (the # and *) allow you to lock and unlock channels.

Comments

This has been an enjoyable project for me. Please feel free to write or call me when questions arise and include a SASE if you write. Many modifications, deletions or additions are possible. Touch Tone could be added easily with the hybrid tone chip, for example. A modification to add 5kHz spacing is also possible. But whatever you devise I hope it improves your hamming.

My thanks to the many hams who aided and abetted the cause and contributed their time and skills. I am particularly indebted to

Don KØTVO, for much information and advice and to Bob WØKGJ, for building another prototype.

A possibly unique feature of my prototype is that when powering it up, the frequency display usually reads ' 73."

PARTS LIST

Power Supply

C3, C4 – 0.22 μF, 50VDC
C5, C6 – 0.01 μF, disk
C14 500 μF, 25 VDC, electrolytic
C15 – 100 μF, 25 VDC, electrolytic
F1 – 2 A fuse
S6 – SPST miniature toggle switch
Regulators – LM309K 5V 1A regulators

Decode and Debounce

C1 5 μF, 25 VDC electrolytic
C2 0.05 μF disk
D1-D17 – general purpose diodes
IC 1 – 7404
IC 2 – 7420
IC 3 – 74123
R1, R2 – 22K, ¼W
S1 – Touch Pad, 16 key, Chromerics (see text)

Memory and Display

DIS 1-DIS 4 7-segment minitron display or 7-segment LED*
IC4-IC6 – 7404
IC7-IC10 7447
IC11-IC13 – 7489 or 8225 which is equivalent.
IC14, IC15 – 7490
IC16-IC18 – 7495
LED 1 – MLED500 LED or your choice
Q1 – 2N3904 transistor or other NPN switching transistor
R3, R4 – 10K, ¼W
R5 – 22K, ¼W
R6 – 150Ω, ¼W
ZD – 9V zener, 400mW

*If LED displays are used add limiting resistors to parts list and schematic for each segment.

Control Board

C7 – 15 μF, 25VDC electrolytic
C8 – 0.22 μF
C9 – 300 μF, 25VDC electrolytic
C10 – 60 μF, 25VDC electrolytic
C11 – 100 μF, 25VDC electrolytic
C12 – 500 μF, disk
C13 – 0.1 μF, disk
IC19-IC27 – 7400
IC28 – 7404
IC29 – 7410
IC30 – 7420
IC31 – 7475
IC32 – 7489 or 8225 which is equivalent.
IC33, IC34 – 7493
IC35 – 74121
IC36 – 74122
IC37, IC38 – 74123
IC39 – 74157
LED2-LED5 – MLED500 LED or your choice.
Q2 – 2N3906 transistor or other PNP switching transistor.
Q3 – 2N3904 transistor or other NPN switching transistor.
R7, R18 – 150Ω, ¼ watt
R8, R9, R14 47K, ¼ watt
R10 – 68K, ¼ watt
R11, R13 – 22K, ¼ watt
R12 – 10K, ¼ watt R15 – 33K, ¼ watt
R16 – 1K miniature potentiometer
R17 – 820Ω, ¼ watt
R19 – 22K, ¼ watt
S2-S5 – SPST miniature toggle switches.

Interface

IC40, IC41 – 7407 or 7417
S7 – 3PDT Miniature toggle switch.

...WAØAQO

James C. Nordgren WB9BNF
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Chicago IL 60610

Poor Man's BFO

The rain splashed hard against my office window driven by the well-known Chicago wind. Meanwhile, back in my apartment lay the latest issue of 73 Magazine and my raincoat. However, on my office desk sat a short-wave receiver, without BFO, and a $2 transistor broadcast-band receiver. The happy thought occurred to me to use a harmonic of the broadcast receiver's oscillator to beat with code stations' carriers and provide a carrier for single sideband reception. I brought the broadcast receiver, turned on with volume low, close to the short-wave receiver, which was tuned to a CW station, and tuned the broadcast receiver until a pleasing audio tone was heard from the short-wave receiver. I found this method successful with CW and sideband stations on the 80, 40 and 20 meter amateur bands. Injection level was adjusted by changing the spacing between receivers. I had so much fun that I hardly noticed when the rain finally stopped.

...WB9BNF

Robert L. Harding
RD #2
Midlbury Center PA 16935

The Torrid Toroid

An in-depth look at the 88 MHz toroid.

The 88 MHz loading coil is some toroid. Not only is it ubiquitous and inexpensive but it can be bought for about 25¢ almost everywhere. Data on it is not so ubiquitous, although most ham constructors seem to have and use these coils in precision audio filters and oscillators. Presumably everyone is thoroughly familiar with them; hence, I recently had to refer way back to the RTTY column in CQ March 1961 to remind myself that, for series connection, the center tap is formed by joining the two wires directly across either barrier.

Even if this article repeats previously published or easily discoverable information, the ready reference may assist in more effective usage of this standard component. It is tedious to strip and count turns, measure, calculate, and get the decimal point in the right place. On the last one I stripped, I got the following results:

368 turns #30 wire in each 22 MHz section
736 turns total for 88 MHz. Wire diameter mikes out at 12.6 mils, including enamel.
Core dimensions (with fantastic accuracy based on my X-ray vision):

od: 1"

id: 9/16" to 19/32"

A: $3/16 \times 3/8 = 0.07$ in.^{2} (cross section area)

WA: 0.235×10^6 circ mils (window area)

P: $13\pi/16 = 2.55$" (mean magnetic path length)

Even if the value A is physically correct, the effective core area will be somewhat less, depending on the ratio of magnetic material to empty space within the core structure.

Once this information is known, stripping the windings from these coils is the wrong way to go. Better, we can remove or add turns to make a precision inductor with any value of inductance, possibly up to 400 MHz. This task is made easier if we first predict the total turns required, halve this number to work on each section independently, and account for the 368 original turns. If adding turns, we simply splice a #30 wire of the appropriate length, including slack for final trimming, onto the outside end of each winding. Incidentally, 100 turns stripped from my coils measured 9 feet long; progressively more wire should be allowed as the winding deepens. A popsickle stick notched at both ends makes a fairly good shuttle onto which the appropriate length of wire is first wound before passing it through the toroid window.

Total turns required can be estimated from the empirical equation: $L = 3.2N^2 \mu A/10^8 P$ where P = in., A = in.^{2}, L = Henrys and μ is permeability. At first, this seems to tell us very little, because μ, A and P all depend on unknown core material and geometry. However, using the data that 736 turns yields 88 MHz and rearranging the equation to solve for $\mu A/P$ (treated as one constant) we obtain:

$$\mu A/P = \frac{(10^8)\ (.088)}{(3.2)\ (736)\ (736)} = 5.08$$

Using my values for P and A, we then get a value of $\mu = 185$. This looks surprisingly low, but suggests that the core has ferrite composition rather than helically wound steel laminates. I didn't crack mine open to find out.

The real purpose of this article is to print the following equation (derived by combining all constants and solving for N in terms of L):

$$N = 2482 \sqrt{L}, \qquad L = \text{Henrys.}$$

Now we can choose our L and calculate N, the total turns. The reader may verify that the equation works for the 88 MHz coils and each 22 MHz section. Now it is clear why series inductances don't just add when they are wound on the same core. In other words, to get the most inductance for your money, wrap all your wire on one core.

Of course, this equation doesn't guarantee that a certain N will produce a certain L in every circuit. That magic number 2482 still involves permeability μ which varies considerably according to the flux induced by current in the windings. Likewise, the original coils have 88 MHz inductance only under the conditions they are designed for.

Someone out there with access to lab equipment could do us a great service by publishing B/H hysteresis curves on these cores.

Personally, for just an 88 MHz inductor, I prefer the potted type. Once upon a time when my scope was working, I figured out the color-coded leads. To connect in series, connect either yellow and orange together or white and blue together, this junction forming the center-tap.

...HARDING

Voltmeter Switch Quiz

Below are illustrated three possible ways of wiring a voltmeter selector switch One has a serious handicap, a second would wind the meter needle into a hairspring, while the third would work nicely. The internal resistance of the meter is 50Ω in each case. Can you separate the sheep from the goats?

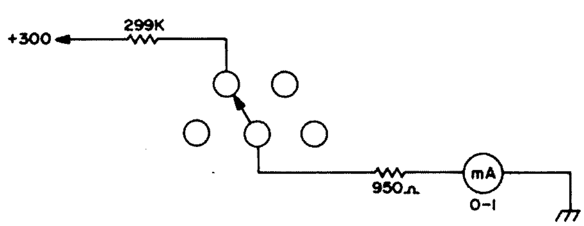

Fig. 1.

In Fig. 1, due to lack of current flow, the switch end of the resistor is at full supply voltage and 300V dc would be applied to a 1V dc meter. This will not contribute to the life of the meter.

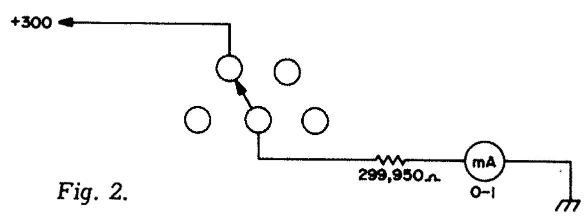

Fig. 2.

In Fig. 2, 300V would be applied to a 300V meter. This would work but all inputs to the meter switch would have to be read on a 300V or higher scale.

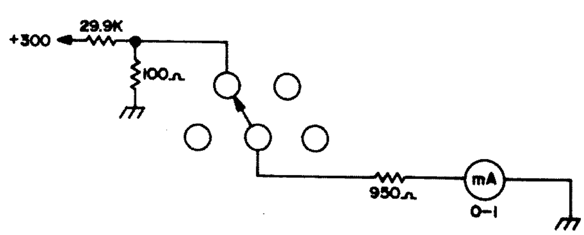

Fig. 3.

Figure 3 protects the meter and at the same time maintains high sensitivity for other ranges and functions.

...WAØABI

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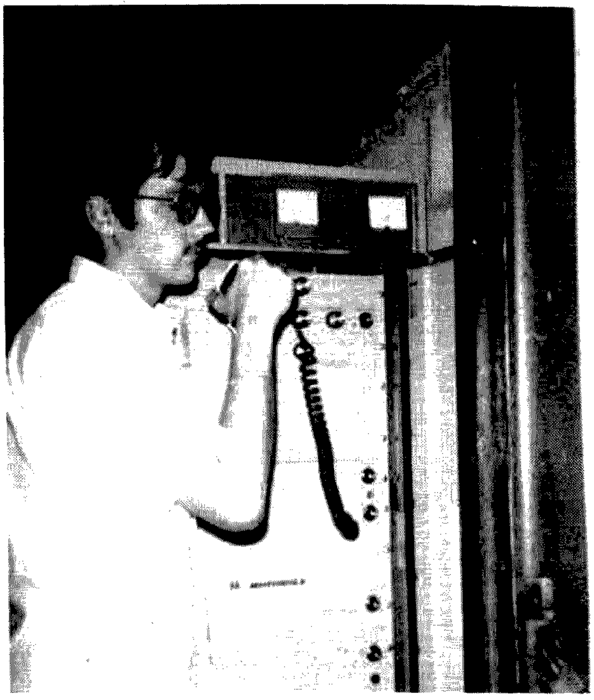
WR3ABC – The Inside Story

Repeaters are made not born. Their inception, development, activation and continued operation take a lot of work, money, time and plain old guts on the part of the relative few who maintain them. I say "few" because in the final analysis there are only a few who are technically competent to "stick" their fingers inside a repeater and make it tick; competent enough to organize an association that has high standards of operation, provides public service support to local government, keeps its user/members happy and motivated and has control stations capable of providing constructive criticism without alienating the feeling of the user. The Green Mountain Repeater Association Inc., is such an organization serving the Washington D.C. and surrounding Virginia/Maryland areas and is the largest Repeater Association in Maryland. A title that took hard work. Here is its story.



Dan Addis WA3TUF, past president of the GMRA, Inc.

Inception

The GMRA was first conceived in October 1971 at the York PA annual hamfest. It was here that 5 local Marylanders decided to put a 2m autopatch repeater on the air to service the Washington D.C. area. All had many years of experience in amateur radio and their own personal expertise in organization, technical ability, legal affairs, public relations and operation. Collectively they had "all the makins" to form a first rate repeater association.

Development

A site was soon selected overlooking Washington D.C. yet high enough to spread a strong signal into surrounding northern Virginia and Maryland. The frequencies

146.01/146.61 were finally chosen with the help of the area frequency coordinator. This saved much time and consternation and helped ward off possible infringement upon an already operating or planned repeater system. A 60W Motorola base station was procured together with a vertical fiberglass antenna, a 4 cavity duplexer and an 80 foot Rohn tower. We had all the hardware, now all we had to do was put it all together into an operating system. No easy chore. While the technicians were putting the parts together including control and autopatch circuits, a license was requested and approved. The call sign WA3KWG was initially assigned (followed later by WR3ABC). Finally, after 500 man-hours of installation, testing, debugging, invention, frustration and more testing, Maryland's first 2m autopatch and The Green Mountain Repeater Association Inc., were activated.

Growth

From the 5 original founders, user participation increased by leaps and bounds. Within 6 months from the repeater activation the association had over 100 members. The repeater saturated the Washington D.C. area and news spread rapidly throughout the FM community that the 01/61 repeater was operational with autopatch facilities.

Public Service

Because of the repeater's very valuable public service potential, it was decided to make the repeater available to the local government's Civil Defense Agency. This was a "no holds" "no bar" proposition. The repeater was dedicated to public service exclusively if needed during an emergency. At the strike of an agreement pen, the local Civil Defense Agency increased its communication potential by over 100 mobile units each having direct access to autopatch facilities. The Civil Defense Director was "damned impressed."

Second Repeater

Well sir, as the membership/user population continued to increase (150 ten months later) the Board of Directors (fancy name for the original founders) started to think about a second repeater. After all, the first repeater was primarily for autopatch and public service support. Why tie it up with "rag chews," short as they may be, especially in view of the projected user growth? It was agreed a second repeater would be planned using the frequencies 28/88 with the blessing of the area frequency coordinator. It didn't take long since these guys work fast. In the summer of 72, less than one year later, the 28/88 repeater was activated. The call sign WA3SFG was assigned, soon to be changed to WR3ABB under the new repeater rules. The 28/88 machine also tied to a 4 cavity duplexer and fiberglass vertical. Talk about growth. Membership jumped over the 200 mark by the winter of 73. That's over 200 users in a little over 14 months.

Movie

To further publicize the association and in particular show people how a repeater is put together, a 15 minute movie with associated dubbed in sound was made by the Board of Directors. The film was such a success that it was shown at the summer of 73 ARRL Roanoke Division Convention at Reston VA. I'm sure many of you readers enjoyed the amateur but professional quality of the movie. It's something that can be shown again and again at Hamfests, club meetings and who knows maybe television. All you need is a good camera and someone who has writing ability, imagination and a little bit of Cecil B. De Mille in him.

Finis

When the smoke all cleared almost 2½ years later, the association had over 250 members, provided primary communications to local Civil Defense government, 2 active repeaters, AUTOPATCH facilities, affiliation with local FM repeater councils and had a color/sound movie of its efforts to boot. Good enough reasons for the Green Mountain Repeater Association Inc., to be called Maryland's Largest Repeater Association.

. . . K3BEQ

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EIGHT FUNCTION REPEATER CONTROLLER

When recounting construction articles appearing through the pages of 73 Magazine in recent years, it is evident that most of the smaller scale projects could be strung together on one piece or several pieces of copper clad board. With a little imagination and some preplanning I decided to standardize a construction format for my station for ease of construction, circuit design, testing, up-dating and reduced cost.

What started my thinking along these lines was WA4YND's fine article in the *73 Repeater Handbook* entitled, "A Repeater Controller." The "plug-in" approach is universal today except for the fact that few, if any, amateurs give thought to the card's environment until after the completion of the project. Items such as plugs, guide rails, chassis, power and indicators are usually afterthoughts which cost more and require more fabrication time than the card itself.

In the September 1970 issue of 73, Roger Taylor K9ALD proposed to the amateur world the modular approach to construction with his article, "A New Approach to Communications Equipment." In this article, K9ALD suggests the 24-pin edge connector as the standard, predesignating pins and proposing card size and housings. Unless anything but the most ambitious project is attempted, most home construction projects would use far less space than that proposed by K9ALD. Fewer than 24-pin connections are also suggested. In developing my own standard, I selected the 15-pin one sided connector used by W. B. Kincaid WA4YND because it readily expands to 30-pins by using a double-sided board. This feature gives plenty of extra pins when necessary but keeps basic projects simple.

The method is most easily employed by creating to your own preference a template or worksheet which is preprinted and used in planning and preparing all projects. The method we used was to merely draw, as accurately as possible, on graph paper, the card outline and pins, edges and similar connecting points, such as a hole for a card puller. By duplicating several hundred of these sheets, circuits may be pasted up on the worksheet, or collected until the project is ready for fabrication. WA4YND's basic card was used because it seemed to be the correct basic size for most chassis and the edge connectors (Amphenol 15-pin type 143-015-04 or Cinch 250-15-30 170) are abundantly available from surplus at very low prices.

Fig. 1 shows the work sheet without circuitry. It will surprise you to find how many of these sheets will be used in planning, grouping and setting up projects. Circuits pulled from magazine articles are then literally pasted on the worksheet in layout form, interconnecting various points and pins using dark ink felt-tip pens. The finished product is a camera-ready-copy for production of the lithographic negative required for printed circuit production.

Complicated circuits, one of a kind circuits, or experimental circuits, may be constructed in a similar format with these additional methods:

a) An "experimental breadboarding card," consisting of a large number of soldering pads, socket pads and copper runs may be made on the basic card, or:

b) Perforated card stock with stick-on soldering pads and edge connectors will produce very fast results ready for mounting and wiring. At a later date, when the card is

perfected, a more permanent card can be produced and inserted into the works replacing the temporary card.

In order to prove that experimental circuits could be constructed in this manner, the WA4YND "Inexpensive IC CW Ider" was constructed using perforated board as suggested but in the card format. The number of specific soldering connections would have made a single sided PC Board very difficult to construct. However, by weaving barewires in and out of the holes on the perforated board and connecting each wire to its corresponding scan generator in the circuit, this new layout enables the identifyer to be reprogrammed.

A case should therefore be made to begin to think about the method, which should be called the Taylor Construction Method (TCM) for its originator, for radio amateur projects for the following reasons:

1. Materials and supplies come cheaper when ordered in larger quantities, use predictable amounts of reactant, and can be cut to size with a minimum of waste. (Two cards may be constructed from a single 7" x 10" piece of PC Stock.)

2. Most every circuit for which a layout has been included can be superimposed on the standard card.

3. Cards may be replaced, improved, bypassed, or traded (mailed) with ease and the "if only I had included" syndrome is all but eliminated in construction projects.

4. Test sets may be constructed serving a large number of projects and can be used again and again, resulting in improved diagnostic analysis, and more importantly, more thorough experimentation.

5. Extension cables, or extender cards may be used to bring an operating card down to the table for close scrutiny while still in the circuit.

6. Basic card "frames" may be constructed and serve as an excellent way to try out new cards, or improved circuits. Also, many amateurs duplicate projects entirely with some modifications and improvements, thus providing interchangeability of circuits. circuits.

Using the above self-imposed standard, the Multi-Function Control Card consisting of "proven circuits" performs a wide variety of functions of general station value to the amateur or for repeater control of systems audio, remote control operations and what I call last minute "fudging," which is always a part of interfacing two or more dissimilar pieces of equipment.

The Card contains the following: A VOX with adjustable delay; speech compressor; a

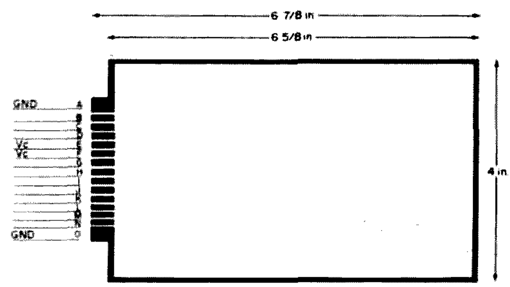


Fig. 1.

line amplifier for driving telephone lines at 600 Ohms (from small signals); an audio amplifier for driving an 8 Ohm speaker to 1W; a small signal audio impedance matcher (hi Z to 600 Ohms or low Z to hi Z); a COR is also possible; a squelch circuit; a medium gain preamp for yielding a flat response for microphone to line or encoder to line or discriminator to line without roll off.

All these functions seem a bit ambitious for a single card but the necessary circuitry is all inclusive (except for the relay) and the circuitboard will receive a wide variety of components and junk box parts. Finally, the card matches WA4YND's Repeater Controller size.

The Circuits

Line amplification has always been a function of sufficient audio and proper match from a telephone line (or remote pair) to a speaker free of hum, and loud enough to handle most listening conditions but using the least amount of power. The usual method of matching is to just add on transformers in order to drive the various necessary inputs. Phase distortion and dropping audio levels usually result. Pins B & C of the MFC-1 provide a 600 Ohm unloaded input for an unbalanced (one side grounded) audio preamplified drive to the LM370, AGC Squelch Amplifier. If an audio level for driving a transmitter is all that is desired, pin 1 of the LM 370 may be

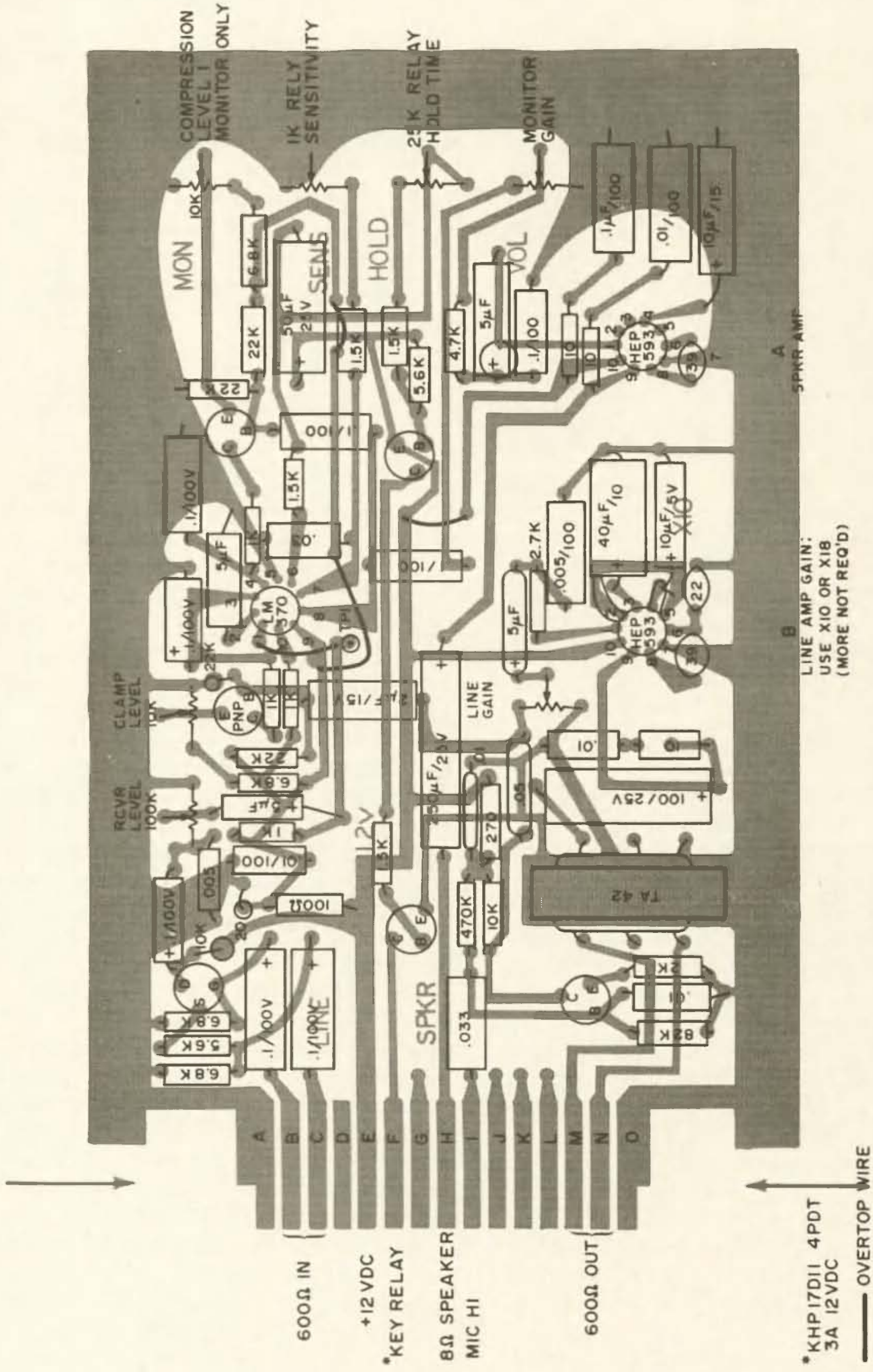
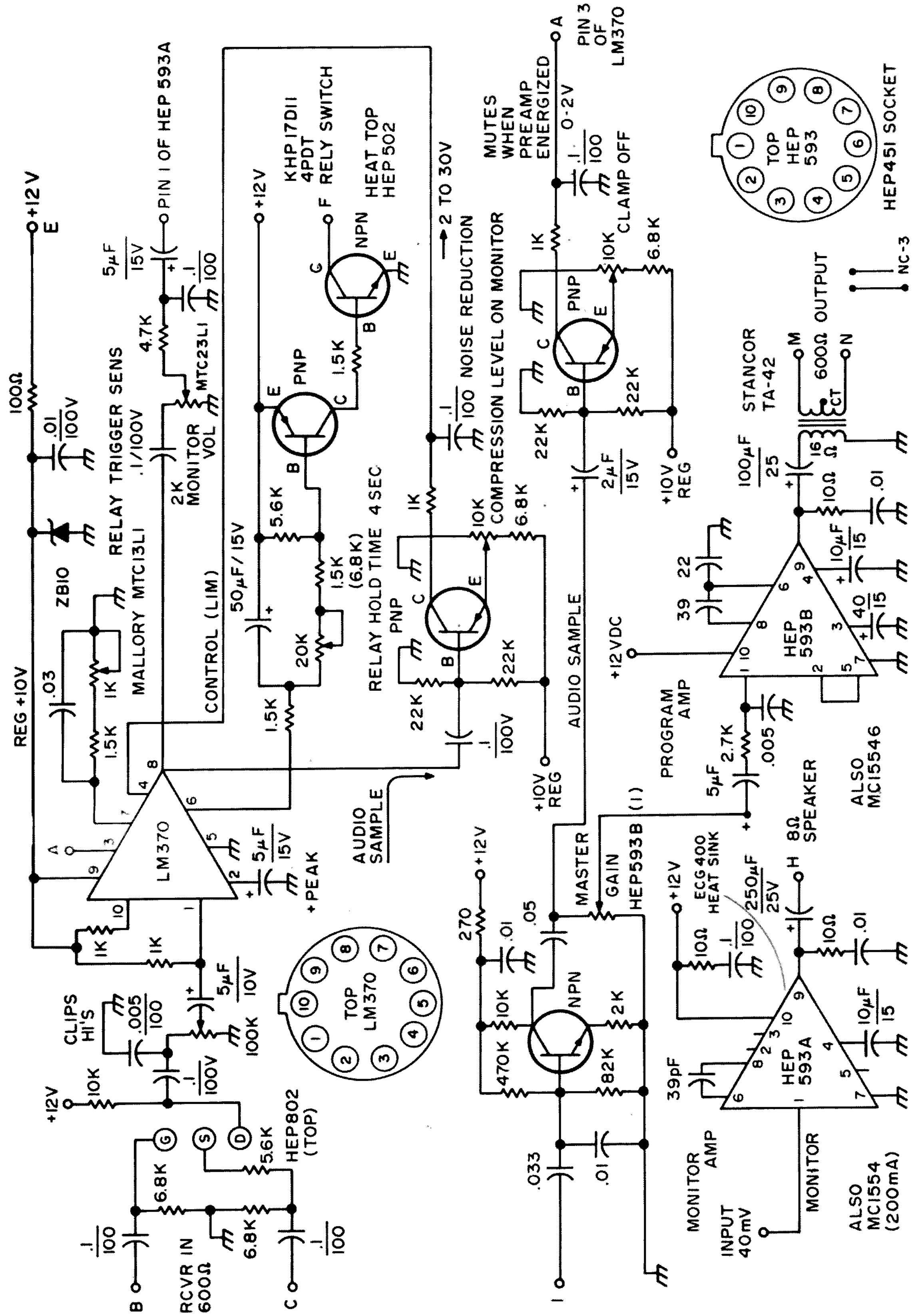

COMPRESSION
LEVEL 1
MONITOR ONLY
1K RELY
SENSITIVITY
25K RELAY
HOLD TIME
MONITOR
GAIN
MON
SENS
HOLD
VOL
SPKR AMP
LINE AMP GAIN:
USE X10 OR X18
(MORE NOT REQ'D)
CLAMP
LEVEL
RCVR
LEVEL
100K
LINE GAIN
12V
SPKR
LINE
600Ω IN
+12 VDC
*KEY RELAY
8Ω SPEAKER
MIC HI
600Ω OUT
*KHP 17D11 4PDT
3A 12VDC
OVERTOP WIRE

Fig. 2.



+12V
E
100Ω
.01
100V
ZBIO
REG +10V
RELAY TRIGGER SENS
MALLORY MTC13L1
PIN 1 OF HEP 593A
5µF
15V
.1
100
4.7K
MTC23L1
2K MONITOR VOL
.1/100V
CONTROL (LIM)
50µF/15V
5.6K
1.5K
20K
(6.8K)
RELAY HOLD TIME 4 SEC
+12V
PNP
KHP17D11
4PDT
RELY SWITCH
NPN
HEAT TOP
HEP502
2 TO 30V
NOISE REDUCTION
COMPRESSION LEVEL ON MONITOR
1K
10K
6.8K
22K
+10V
REG
AUDIO SAMPLE
MUTES
WHEN
PREAMP
ENERGIZED
0-2V
CLAMP OFF
PIN 3
OF
LM370
2µF
15V
LM370
+PEAK
10V
100K
CLIPS
HI'S
.005
HEP802
(TOP)
6.8K
RCVR IN
600Ω
TOP
LM370
270
.05
.01
470K
82K
2K
.033
MASTER
GAIN
HEP593B (1)
+12V
+12VDC
39
22
HEP
593B
PROGRAM
AMP
2.7K
100µF
25
16
Ω
10Ω
10µF
15
40
STANCOR
TA-42
600Ω OUTPUT
CT
8Ω
SPEAKER
ALSO
MC1554G
ECG400
HEAT SINK
250µF
25V
39pF
HEP
593A
MONITOR
AMP
INPUT
40mV
ALSO
MC1554
(200mA)
TOP
HEP
593
HEP451 SOCKET
NC-3

Fig. 3.

brought directly out of the card at pin D on the edge connector for later reconnection. The bridge from pin 1 to the LM 370 may be retained as it is unloaded, or it may be broken if adding another input.

AGC/Squelch Amp in the VOX or COR mode. The smoothed output of the LM 370 is applied through a gain control (monitor volume) to pin 1 of the HEP 593 (MC1554) as an audio amplifier driving an 8 Ohm speaker directly from pin H of the edge connector without need for a transformer. The purpose of the AGC on the line amp is to insure that its output, which also could be brought out to pin D as above, from almost any telephone line used will provide uniform gain to the output and to the speaker. It may seem strange to drive a speaker from a compressor amp but this will be explained later when other parts of the card and their inter-relationships have been described. From pin 6 of the LM 370 are the adjustments of the delay time (hold down) and a driver transistor for an external VOX or COR relay. Pin F of the edge connector may be connected to any relay and positive supply provided that the voltage and current limitations of the transistor are not exceeded. Thus, when a signal appears at B & C, the relay driver will engage an external relay (a KHP 17D11 was used) and hold it down for a selected period of time (varied by the "delay" control) after the audio at a selected level (relay sensitivity) disappears.

Microphone Preamp/line drivers. A discriminator or medium impedance microphone may be connected to edge-connector pin 1, the output of which can be made to drive a second Hep 593 which, in turn, drives the remote 600 Ohm line at pins M & N. Voltage for transmitter control may likewise be inserted at the center tap of T-1 for simplex (phantom ground) line control. It was noted that the AGC amplifier drives a speaker instead of a line amplifier; the dynamic range of the LM 370 is so great that edge connector pins B & M and C & N can actually be tied together to serve as a relayless half-duplex two-way wire with dispatch audio control. This is made possible by taking advantage of an auxiliary mute input to the LM 370. The IC can be made to shut down partially or completely (within a range of approximately 2V dc) during microphone input. This feature presents many audio-control possibilities when using wireline remote control or rented lines. Further, any telephone hybrid can be placed at the repeater site, and the telephone line inserted at the dispatch point (rather than the control point) as a totally matched and controlled system. Several of these methods are not common in the amateur service but are used extensively in commercial service where cost is a greater factor.

A word about the HEP 593 audio amplifier IC's is in order because this device can do several interesting things. Gain selections can be "hard wired" into the board by placing capacitors at different pins and cutting the board where necessary; for a gain of 10x, leave pin 2&4 open and ac ground pin 5 through a 10μF capacitor; for a gain of 18x, leave pin 2&5 open and ac ground pin 4 with the 10 μF capacitor (Fig. 2); and finally for a gain of 36x, connect pin 2 to 5 and ac ground pin 4 through the 10 μF capacitor (Fig. 3). It should be noted that feedback at this high gain level could be a problem. I encountered some very high frequency instability at 36x which was corrected by using a "stiffer" power supply. At first the instability was not noted because of the very high frequency (in the order of 40k) but output was very low and power consumption was high for no visible reason. A check with an oscilloscope quickly found the nature of the output which was corrected with a modifcation to the supply voltage.

The Multi-function Control Card can be used as a total system, inter-connected, or as separate units for separate reasons. Several other cards of a similar layout have been constructed using this format and also work in a multi-function mode, including a 2805 pulse decoder, "tone-cosmetics for the station (a card which generates a busy-tone, dial tone, ringing tone, and beep tones so that all that "dead air" can be put to use) and several repeater controllers for autopatch and mobile to mobile. If these cards prove interesting we will be sure to send them along to 73 for consideration in the months ahead.

. . .W3JJU

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Nicads - a Shocking Exposé

Nicad batteries are used almost universally in small hand-held and portable transceivers. They have a number of advantages over other rechargeable batteries in that they are relatively cheap, don't leak (much) and if respected a little, last a good long time.

First, let's compare them to ordinary flashlight batteries (carbon-zinc). Carbon-zinc types have two electrical problems: they have a relatively high internal resistance (making it difficult to extract high transmit currents without a significant voltage drop) and they gradually drop their voltage as they are used up. Also, they cannot be recharged, in spite of what some charging manufacturers say. Nicad type batteries have about the same capacity (amp-hrs) for a given size but do not suffer from the two above problems. The internal resistance is very low which means that you can extract several amps from an AA size cell, making them nearly ideal for transceiver applications. The voltage remains nearly constant (1.2 V fully charged; 1.0 V at discharge) over the life of the charge. This makes for proper, consistent and uniform transceiver operation during the duration of the charge. Note that the cell voltage for nicads is lower than carbon-zinc. (1.5 V when "fresh") so it usually requires 10 nicads or 8 carbon-zincs to make 12 V.

Manganese or "alkaline" cells are another common chemical type that have characteristics of carbon-zinc cells but are rechargeable. *All* alkaline cells are rechargeable (even if they are not so marked), but two problems exist. First, the impurities in the chemistry will degrade the battery capacity so it is only practical to recharge them 3 to 10 times and secondly the overcharge (continued charging after the battery is charged) will cause the chemistry to generate an internal gas pressure. If the charging current is relatively high (200 mA or more for AA size) this gas pressure could cause the thing to explode (actually it just cracks and oozes caustic soda all over your expensive electronics). The alkalines that are marked "rechargeable" have vents to prevent this mess.

Note that during the constructive charge period, the chemistry doesn't liberate gas, only during the "overcharge" condition. So if you're careful about how you go about it, even the unvented types can be recharged many times. It is best if the alkalines are only discharged to about half their capacity before recharging as the degradation is much less and the total life can be maximized.

Mercury batteries are about 75% the cost of the average nicad, have 1.4 V of good constant voltage and for a given size have about 7 times the amp/hour capacity of nicads. They are not rechargeable but for an extended period of use where there are no facilities for recharge, they are ideal.

So much for all those things and back to your already-bought nicads. Although they come from the factory mostly discharged we will first try to confuse you by discussing discharging (or using) the things. With their very low internal impedance, it is possible to extract huge amounts of current from nicads (but not for huge amounts of time). If you happen to short your battery pack for 20-30 seconds with, say a screwdriver, the current flow will heat the little terminal springs red hot and melt the plastic case, causing you to utter all sorts of noises, particularly if you

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Santa Barbara Amateur Radio Club
P.O. Box 3232
Santa Barbara CA 93105

were holding the case on your lap at the time. This tends to ruin the springs, which by this time have turned to very rugged solder, the plastic case, the batteries, and your lap.

The arch enemy of nicads is excessive temperature. Not the leaving-it-in-the-sun or hot trunk kind of excessive temperature but the over 300 degree type of internal temperature caused by the rapid discharge of a short circuit. The internal impedance is low but not zero. All that current can I^2R the poor battery into a rotten pumpkin. You can safely discharge AA size nicads at rates of 5 amps without damage. This means that those little things in your handheld can power your 25 W base station (albeit, not for long; how about 5 minutes?). Now, if you want to be more practical and use them in your 146 or TR22 you can talk for about an hour and a half OR YOU CAN LISTEN FOR ABOUT *TEN* HOURS, (does that give you any ideas?).

Now that we have discharged our batteries by all that talking, we have our first real peculiarity of nicads. Us ham types usually string up 10 or so nicads to come up with 12 V. If one of the cells discharges before the other 9, the voltage out of the string will only drop to 10.8 V (you'd keep right on talking) but the current (450 MHz for the 2 W radios) would be busy trying to charge this kaput cell in the wrong direction. If this condition continues for only a few minutes, no harm will be done. However, if this condition persists, the cell chemistry will change and that cell will not accept a normal charge and will look like a short circuit in both directions. This brings up some interesting suggestions. Always buy your nicads at the same time, don't mix cells of different ages or brands. Try to match their discharge time so some don't discharge before the others. Fully discharging nicads does not hurt them except when they are unequally charged as we discussed above. Always fully charge new cells before discharging so that an equal initial charge is assured. If a series of nicads are to be used together, charge them together to keep their state of charge equalized.

. . . **WB6JPI**

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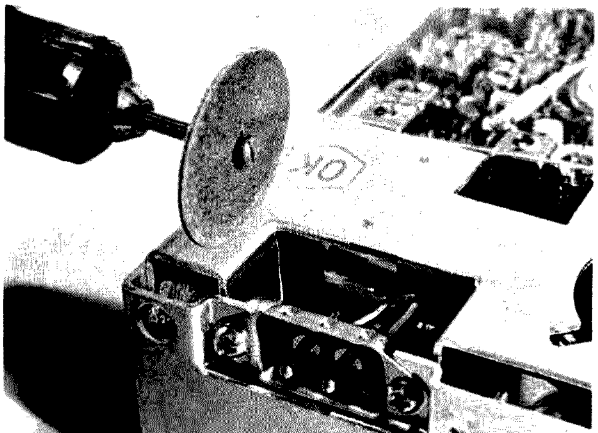
PREAMP FOR THE TR22C

The problem was space.

If you take a look into the guts of a TR22C Drake two meters transceiver you will arrive at the conclusion that every square centimeter has been used, and there is no room for any major modification.

I don't want to insinuate that the TR22C needs modification or change. It is a nice little rig, well engineered, compact and good looking. The TR22C is made in Japan, but under very rigid specifications set by the Drake designers.

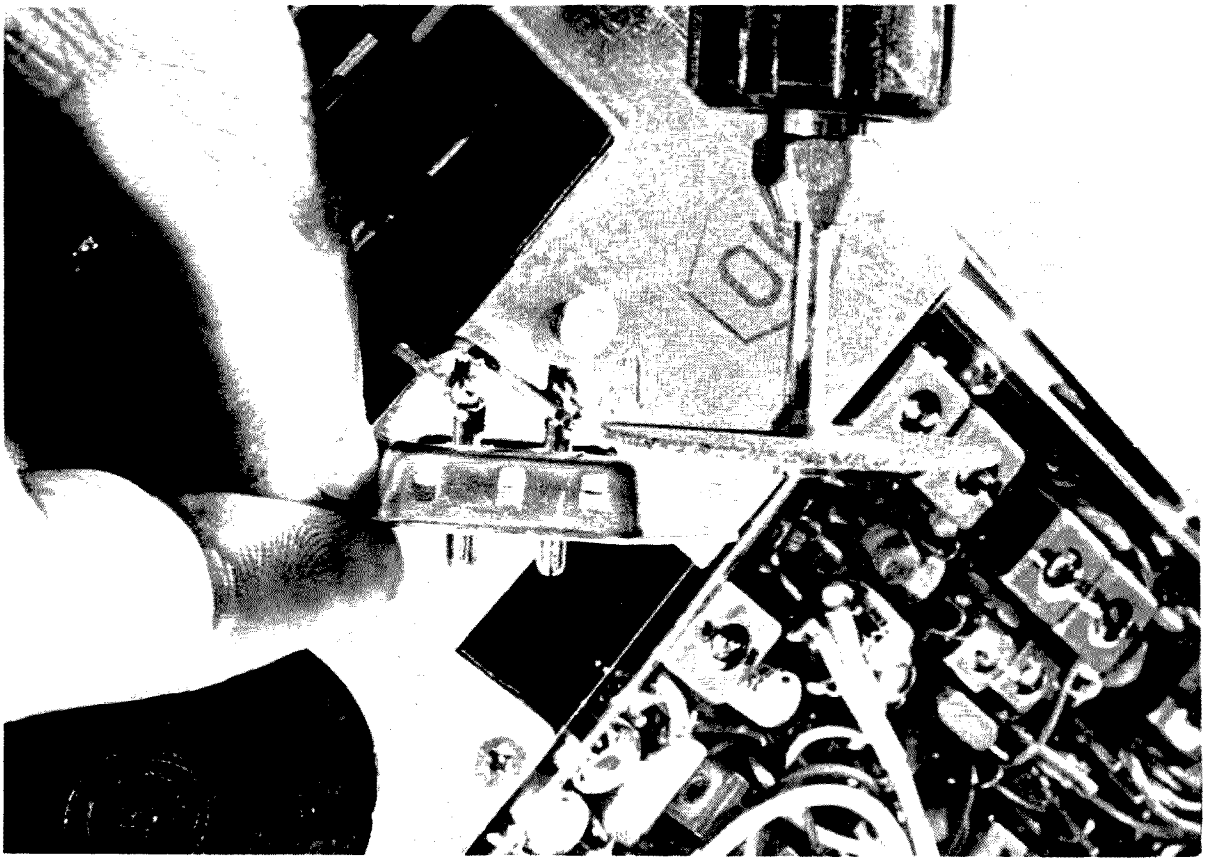


With an abrasive disc on the Roto-tool, cut off the aluminum flaps. Notice the battery spring holder where the ground edge of the board will be soldered.

However, I am the kind of cat who likes to change things around, even if they are already in the proper place. Every piece of electronic equipment I own has been modified in one way or another. The TR22C "ain't" going to be the exception, so I decided to install a preamplifier into this cute little rig. But where? I took the cover off and started looking for the space for my preamp. I decided to build a preamp I saw in the Handbook – only one FET, two inductors and two ceramic trimmer capacitors, a few capacitors and resistors, etc. I etched a board 3 by 5 centimeters and crammed all the components onto the epoxy glass board. After a lot of thinking and looking I decided that the only available space was under the battery compartment, behind the ac outlet.

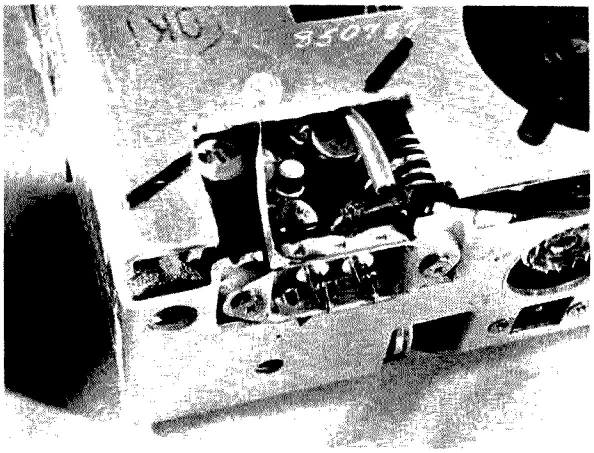
I had to cut out with my Roto-tool two metal flaps (see photograph), cut short the ac prongs, and insulate the connectors with rubber cement and a piece of thick plastic tape.

I'm the kind of cat who likes to change things around . . .



With the Roto-tool cut the back prongs of the ac connectors, and then resolder the wires and insulate with thick tape and rubber cement.

The ground edge of the board was soldered to the spring holding the battery, and a piece of window sealing foam (very handy around the shack) insulated the bottom of the board and the sides to avoid short circuits.



The preamp already installed behind the battery and the ac outlet. Note the shield to prevent interaction between input and output.

The hookup was made with some thin coax (RG174/u) between the receiver input and the antenna relay by breaking the input to Ls1 (called RA on the circuit diagram). This is on the input of the first rf amplifier Qs1 and is simple to change. The plus voltage (the preamp uses 12 volts dc) was tapped on the receiver board.

With this modification the reception of the TR22C was improved close to 20 dB and some intermodulation I was experiencing in certain areas of Miami was quieted to almost nothing.

Of course, these changes void the warranty on my rig, so I recommend waiting until the warranty is over, in order to avoid any trouble. Hi.

. . .WB4SNC

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Ma Bell vs. Foreign Attachments

Joe Blow is flying his light plane mostly on the fumes from the fuel that used to be in his tank, and the weather has closed in. He contacts the tower by radio, and the tower clears him to land immediately. It turns him over to ground control approach. A couple of turns to identify his radar blip, and GCA gets him headed for the runway. He is about 150 feet up, and in the proper glide-path, near the edge of the airport where all the water towers and high lines are. And now the controller's voice disappears!

Joe's abdominal muscles are already as tight as they can go. He can't see anything but his instruments; he is trying desperately to hold his air speed so that he doesn't dive into the high lines or stall out and spin in. After ten long agonizing seconds, however, Joe heard the controller's calm voice correcting his heading and glide path. He landed OK.

What happened? The leased line, or "pair" between the radar location and the remote airport transmitter had developed trouble. While the latter was only about two air line miles away, the actual route was over six miles in length. The pair must follow the right of way for obvious reasons. It may have to follow a circuitous route to pick up a repeater, say, or for other reasons. And it may be grouped with a variety of other pairs in a cable, or several different cables. The other circuits may be toll or local, government or private line, broadcast station loops, anything. It is impossible to segregate any given pair. The only thing to do is to treat each facility as if it were of the first importance.

Let me be clear at the outset: I am not privy to legal and political and financial considerations that pertain to leased wires and customer relations – these all lie well outside my interests and abilities. I wouldn't speak for Ma Bell even if I could. Moreover, no one man could speak for so many different companies except as their agent.

Nevertheless I know, sometimes better than I would like to know, the technical considerations that determine some of these policies. To draw a parallel, the patrolman on the beat could not discuss department policies with the authority of the police commissioner, but he has first-hand knowledge of the crime conditions that make them necessary. The technical picture is the one I intend to draw. The business office of your local telephone company (TELCO) can answer any question not answered here.

The man on the street, and sometimes even the well-informed ham thinks that there is only one telephone company and won't even listen to explanations to the contrary. He knows that his phone goes somewhere; mostly he doesn't care why or how, so long as it does.

Besides Ma Bell and her brood, there is the General Telephone axis, and myriad smaller companies scattered all over the country. Every last one of these is franchised, and this for public convenience and necessity. You don't know what inconvenience is until you live in a town with two telephone companies. You have to subscribe to both, or be out of touch with half the town, always the wrong half. Years ago states learned to franchise only one company for a given area, and to set up a Public Service Commission to control the companies and take the place of free competition, which is not practical in the case of a

public service.

Franchised companies must answer to their state Public Service Commission. And if they do interstate business (long distance) they must answer most particularly to the FCC just as radio stations and radio operators do. This covers technical matters and financial, also. If they gave you that extension jack for free, they'd have to explain why in detail and in triplicate to all the higher authorities. So you get no freebies.

Nearly all hams believe implicitly that the reason their Telco doesn't want them to phone-patch is because Telco might lose the revenue of a toll call. Now, while it is perfectly true that stock dividends are not paid in lost revenues, this is not the first consideration – it's the last. I've worked for AT&T over forty years; I've discussed this very point with local company men – installers, test-desk men, Telco engineers (several) also AT&T engineers, supervisors, craftsmen, chiefs, etc. The lot of them agree without any reservation or hesitation whatever that revenue is not the prime reason. Protection of service is. It is the only thing on earth they all do agree on.

Now suppose the ham – no, he doesn't even have to be a ham – suppose the subscriber has picked up a subset (telephone instrument) from any of several surplus outfits and wants to install an "unofficial" extension. Ever look into one of the modern subsets? Incredible! He manages to get one side of his line grounded – it's easy – which makes a heavy hum on the line. His line happens to be in the same cable as the pair from the airport, which also picks up the hum by induction. Theorists might point out that this does not necessarily happen. I agree, but non-interference requires a simple set of operating conditions. You can run stop signs all day without getting hurt so long as you are the only one in the intersection. Now there are many conditions that can make that line hum a serious matter, to other circuits as well as the airport line. Suppose Joe's circuit happens to be connected to a repeater and that repeater howls?

Anyhow, Joe couldn't hear the controller and was in deep trouble. The subscriber, finding that the new set didn't work for some reason, disconnected it. Now, suppose he had gone to the kitchen for a beer first, Joe would have spun in. There are any number of troubles that might have cut Joe off – the example given is a perfectly possible one.

The Telco calls anything hooked onto a telephone line that it doesn't furnish a "foreign attachment" and since in this story I am trying to show the Telco point of view, I also call phone patches "foreign attachments," since this is what they actually are.

For many years Telco has answered all phone patch requests with a firm NO until the Carterfone case came along. (FCC68-922 20284). The Carterfone is a device used to connect a mobile radio circuit with the Telco plant. The FCC thought this was a good idea, and ruled that Telco had to permit this, subject to plant protection and privacy considerations. This means that the subscriber was responsible for levels used and the introduction of any frequencies that might get into other services and cause trouble. Privacy of communications is, of course, an old story to any ham.

So Foreign Attachments became CPE, customer provided equipment, and Telco designed what they call "couplers" to serve as the interface as between Telco Facilities and the subscriber's equipment, to protect Telco's plant. (Couplers are not expected to do anything else.) If you want to connect directly to any telephone line, you must go through the Telco business office and get a coupler. They will install it for a nice round sum, but the monthly charge is nominal. It has an ordinary jack in it – the device provides dc isolation, peak limiting, and frequency limiting – and you plug in your equipment as you would plug a headset into your receiver. Your telephone is left in place for dialing, ringing and call-registration control.

The voice coupler is connected through your telephone, and the exclusion switch is made a part of the hook-switch assembly. One of the buttons in the handset-cradle is made to pull up and snap into position, which cuts out the subset and connects directly through to the voice coupler and whatever you have connected to it. When you are through using the special voice

equipment, just hang up the handset which automatically depresses the exclusion switch as well as the hook switch and your phone is ready for normal service – you can call or be called, and the voice coupler is now out of service, and will not interfere with normal telephone operation.

What if you want to use the voice coupler without the phone? You can't do this. You couldn't tell if you were being signalled, you couldn't dial out, and toll calls coundn't be automatically registered to you for billing. No go.

All right, suppose you got a surplus subset from any of several outlets and installed it yourself? No go.

A telephone network is unimaginably vast and complex. The FCC recognizes this and backs up Telco in the company's reservation of signalling rights. The reason – compatability. Your dial or touchtone or key-pulsing or whatever has to operate anything in the country – Bell System, General Tel, or Skunk Hollow Telephone & Grocery Co, Bait & Boats rented. It has to work this way. True, you can buy surplus sets guaranteed to work from any number of suppliers. But what does the guarantee mean? What does surplus mean? Means somebody didn't need it. Maybe it is brand new Kellogg, Stromberg, Ericson or whatever equipment. Maybe it was pulled out of "working equipment" for the very reason that they wanted to keep it working. I must admit that I have heard of Telcos who have tested such instruments owned by subscribers and given permission for attachment for its connection. But the FCC says no, the PSC says no, Telco says no, and I believe that the practical solution is to go around and not through.

So why not use acoustic coupling – just pretend that your ham station is just a person, with the loud speaker a mouth and the microphone an ear. How about that!

Before you get carried away, permit me to point out that the FCC, the PSC and Telco all have regulations about this, which they all feel most strongly about. The idea, which I personally favor, is not useful for evading regulations; it does put you on your own, however, and with a little intelligent planning, will provide the workable solution you're after.

The idea that regulations applied may be a shock, but it shouldn't have been. You know that there is no excuse for profane or indecent language on the land lines as well as on radio circuits and channels. The secrecy of communications idea applies also, and the FCC enforces both of these as you well know.

Later on in this article, you will find a quotation from FCC material, reproduced with their permission, giving level and frequency data pertaining to acoustic coupling, where no physical or electrical attachment exists. A little study will show that these data pertain only to protection of plant, and are binding on every subscriber.

A normal user does not have to worry about levels and frequencies – he can only yell so loud, and he's no lyric soprano either. But hook a radio circuit even acoustically to Telco and problems arise.

The first of these is level. A bunch of plain old cable pairs must all have about the same level, or else the high one will crosstalk (QRM) with all the others. This is just a problem of electrostatic and e-m fields, nothing more. If non-linear devices are present, then you get over-modulation, and the production of new frequencies that may go anywhere and do anything – interfere, put pigeons on your TV screen, or shut off the power upstate by false operation of a telemetry circuit.

The second is frequency. The higher frequencies, especially, get into carrier channels they shouldn't and various kinds of hell break loose.

On the FCC list, #6 is interesting also. Here, the FCC is talking about Telco signalling. This is very often a kind of voice-frequency telegraph system, with a signal tone being amplified, detected and used to operate a relay which operates the local signalling circuits. So you receive a heterodyne of about 2700 Hz, at not very high a level, hardly annoying to your talkers and – blip! – the receiver operates the relay which dumps the circuit as it is programmed to do when the call is over.

This point is always overlooked since it never happens on local calls, and few know Telco plants that well. But it will pay you to include some kind of notch filter, or what-

ever, to get rid of that 2700 Hz tone. It needn't degrade speech quality much. And a filter to pass communications frequencies may turn out to be quite cheap – sometimes you can buy them in surplus for less than a dollar, or you could build your own.

So far as notifying the FCC or Telco about your acoustic coupler, I'm convinced that they couldn't possibly care less, so long as you hold up your end. But since your log has "the force of a sworn statement" to the FCC, it would be an excellent idea to describe your phone-patch somewhere therein, together with diagram and working levels. It might save you a deal of cheap conversation, some day.

Overseas telephone has its own variety of phone patch. They have hybrids and privacy equipment and TOLAs and LREs and VOGADs (Volume Operated Gain Adjusting Device, a very sophisticated level control) VODAS (AT&T VOX) and all manner of other junk – a whole bagful per circuit. They do not attempt to operate both directions at once, though this is theoretically possible.

Perhaps I should mention that TOLA is a tone operated loss adjuster, LRE is a limited range expander (a super squelch) and the VODAS is a voice operated device anti-sing, the switching device. Mostly it works just with normal conversation and the parties don't realize it is there. But if they both attempt to talk at once, or one gets to crying, or one end has a noisy line, the device locks up and nobody talks. The technical operator then takes over and switches by hand and gets the subs started talking again. Voice control has its limitations.

Now, the actual phone patch. I'd start with an auxiliary cradle for the handset, so it wouldn't roll off. It would stay in the phone patch cradle under its own weight. Under the phone transmitter would be a small loudspeaker to drive the handset mike, and under the receiver, your microphone. This latter would need some thought – some people can really blast a phone receiver, so maybe an acoustic diaphragm that could slide between, or maybe a lever that would drop the mike away from the receiver? You can't put a volume control on a telephone, and mikes do blast. You don't need much between mike and transmitter except the usual amplifiers. The transmitter should turn on the instant the antenna is connected and the receiver disabled.

This should be under the operator's control, using a single button or switch for change-over. The receiving side is more critical – it needs an audio band-pass filter to cut out the higher frequencies, and perhaps a notch-filter set at 2700 Hz would be a good idea. Doesn't have to be awfully deep – every little bit helps. But if toll connections get dumped on you, better look into this notch business and make it a little deeper. Then you need a good – and I mean good – limiting amplifier to keep the level within bounds, unless you're greased lightning on a volume control. A couple of pilot lights to indicate the position of the switch would help. And you need some means for listening to both sides of the conversation so that you can switch intelligently.

That much is enough to keep a sharp ham busy for quite a while. First he has to set up a good radio circuit because without it, the best patch is no good.

Recording? Sure – good idea, but by FCC Regulations you need a beeper to let both ends know they're being recorded. Build one? One of the magazines had full directions not long ago. Because the FCC says this must be furnished by Telco, the man told me that this regulation was being interpreted rather loosely! So now you know.

Obviously, there are problems, several of them, but nothing that would prevent or even slow down a good ham from whipping up something suitable, once he knows what's what.

Appendix D, FCC 68-1234, 24346

Technical criteria for all terminals and systems connected by acoustic or inductive means (Effective January 1, 1970).

(1) The power of the signal at the output of the network control signalling unit (#1) shall not exceed 9 dB below one milliwatt (#2) when averaged over any three second interval, and such signal at such output point shall be controlled so that:

(1) The power in the band from 3,995 Hz

to 4,005 Hz shall be at least 18 dB below the power of the signal as specified in (I) above.

(2) The power in the band from 4,000 Hz to 10,000 Hz shall not exceed 16 dB below one milliwatt.

(3) The power in the band from 10,000 Hz to 25,000 Hz shall not exceed 24 dB below one milliwatt.

(4) The power in the band from 25,000 Hz to 40,000 Hz shall not exceed 36 dB below one milliwatt.

(5) The power in the band above 40,000 Hz shall not exceed 50 dB below one milliwatt.

(6) The signal shall at no time have energy solely in the 2450 to 2750 Hz band (#3) and any signal power in such band shall not exceed the power present at the same time in the 800 to 2450 Hz band.

Author's personal interpretation: (#1) The telephone subset. (#2) Could be much lower. Average level in Central Office is negative 23 dBm or 1/200 of a milliwatt! (#3) Obviously protecting the 2600 Hz Telco uses for signalling.

. . . WB2PAP

73's Guide to 2m Hand Transceivers

	Clegg	Regency	Standard	Tempo	VHF Eng.	Wilson
Model	HT 146	HRT 2	SR-C 146A	FMH	HT 144	1402SM
Price – less batteries	$217.00	$179.00	$298.00	$199.00	kit $154.95	$239.95
Channels	5	5	5	6	4	6
Size – height (inches)	8.5	9.8	9.0	8.5	9.3	9.0
width (inches)	3.2	3.3	3.0	2.9	2.5	2.9
depth (inches)	2.3	1.9	1.6	2.0	1.5	2.0
Weight with batteries (oz.)	26	40	32	27	25	30
without batteries (oz.)	18	32	24	17	15	20
Power – Transmit current	.250	.600	.620	.500	.500	.410
Receive w/squelch	.005	.030	.015	.020	.015	.015
Receive – Peak	.130	.100	.100	.150	.100	.150
Transmitter – power – watts	2.0	2.0/1.0	2.0	2.0	2.0	2.5
Battery used	Nicad or Merc. pack	MA-50	10-AA	10-AA	10-AA	10-AA
Price of battery supplied	6682 $24.95	14.4V 50 mah $70.	$43.00 SC-UBP-1	None Supplied	BP-12 Nicad pack $29.95	Nicad $14.00
Receiver Sensitivity uV dB	12 dB .35	.70	.40	.50	.35	.30
First IF	10.7	10.7	11.7	10.7	10.7	10.7
Second IF	455	455	455	455	455	455
net cap Rx Crystals divide by	3	3	9	9	3	9
Rx Crystals Formula	WA	35Ω Ser. (-600 Hz)	NA	Anti-R 78 pF	Par 20 pF	81 pF
Xmt Crystals Divide by	8	12	18	12	8	12
Xmt Crystals Formula pF series or parallel	Par 20 pF	30Ω 32 pF	Par 24 pF	Anti-R 78 pF	Par 20 pF	NA
Mike & Speaker Separate	No	No	No	No	No	Yes
Antenna Connector type	BNC	NA	Motorola	F-type	BNC	TV
S-Meter & Battery Indicator	No	No	Yes	Yes	No	Yes
Remote mike & speaker	No	Yes	Yes	No	No	Yes
Rubber Duckie Ant. (price)	$5.95	$13.00	$6.00	$9.95	$12.95	incl.
Remote Antenna Jack	Yes	Yes	Yes	No	Yes	No
Earphone Jack	Yes	Yes	Yes	Yes	Yes	No
Power Jack	Yes	Yes	Yes	No	Yes	Yes
Crystals included No. of chans.	1	1	2	1	1	3
Speaker-Mike cost	$9.95	$9.95	$36.50	N/A	None	$24.00
Charger – cost	$54.95	$29.95	$28.00	$29.00	$4.95	$29.95
Case – cost	$11.95	$16.00	$8.50	$10.00	$8.00	inclu. $12.00

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The Two Dollar Amplifier

Whether you are a newcomer to 2 meters, an old-timer rediscovering the band, or a regular repeater user, you must admit that its wide open spaces are great fun. With virtually no QRM and small-size antennas, the band is a joy to operate.

Many hams, however, have made the mistake of sinking all their money into equipment and then, with little or no money left, find that they are seriously limiting their operating range by using dipoles or whips because they can't afford to buy a beam. The solution to this problem is simple. Build one. Construction of a beam for 2 meters is easy and cheap. Take a look at the antenna described below. It can be built for just a couple of bucks. You might even find that you have all the "makings" lying around the house.

Now that you know that a 2 meter beam is cheap and easy to build, you're probably wondering if it will work. Well, you should get about 6 to 8 dB of forward gain out of this antenna. This is roughly equivalent to raising your power about 4 times! Let's quit talking and begin to build. Your beam will be finished in a couple of hours.

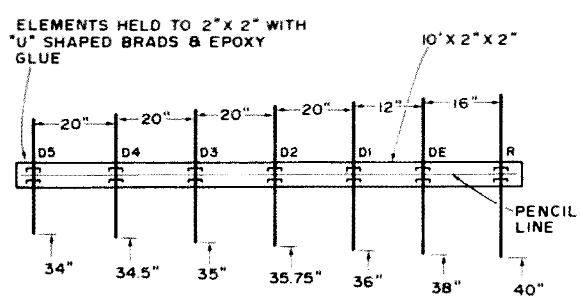


Fig. 1. Top view of 7 element beam.

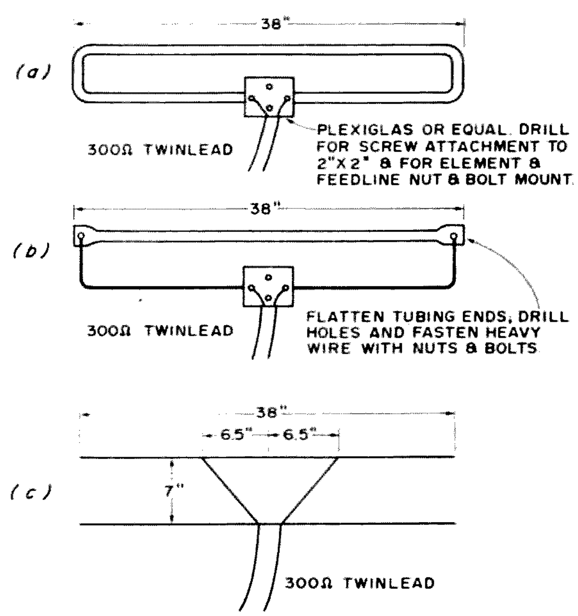


Fig. 2. Driven element details.

You can begin with the boom. Try a piece of 1" x 2" if you like, but you will find 2" x 2" to be rigid, light, and not at all unwieldy. If you like, put a couple coats of shellac on the boom. Draw a pencil line longways through the center of the entire boom. Now measure the boom for the

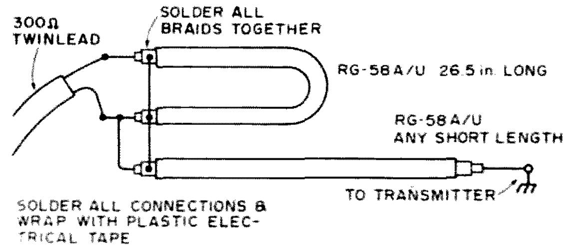


Fig. 3.

placement of elements by drawing a line across the boom at each point an element will be attached as shown in Fig. 1.

Next, prepare the driven element. Three methods are shown in Fig. 2. Figure 2a is a folded dipole made of one continuous piece of copper or aluminum tubing (auto gas line is suitable, but a bit heavy). In Fig. 2b, the folded dipole is constructed by attaching heavy wire to a piece of aluminum tubing, while Fig. 2c shows still another feed method which may require a little experimentation with the taps.

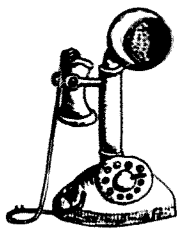
Now cut the reflector and 4 directors from a piece of aluminum clothes line. If you want to be real fussy about straightening them, roll them between two boards. After the elements are cut, and straightened, put a pencil mark at the mid-point of each element. Match these pencil marks with the center line on the boom, so that the elements will be centered on the boom. Fasten the elements to the boom with "U" shaped brads. Dab on some epoxy glue and the beam is finished.

Perhaps, your transmitter or transceiver, like many that are available today, is not designed to work with a 300Ω transmission line. Again, this is no problem. Just make and use the simple balun shown in Fig. 3. However, you should use the best grade of 300Ω line that you can afford.

All that's left now is to get your beam up in the air as clear and as high as possible. You can mount it vertically or horizontally. If you have a rotator, by all means, use it.

With my beam mounted vertically on top of a twenty foot high two-by-four, I consistently work through a repeater that is forty miles away, and this is with only 10 watts input. Now, tune up your transmitter and enjoy the benefits of a really "cheep" beam.

... W8DYF



Basic Telephone Systems Part One

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Lifting Ma Bell's Cloak of Secrecy

Though telephones predate radio communications by many years, they aren't nearly as simple as they appear at first glance. In fact, some aspects of telephone systems are most interesting and quite ingenious. In this article we will describe some of these more interesting and perhaps less well-known areas of telephone systems.

But before going farther, let me explain and apologize for the fact that some of the information in this article may not be altogether complete, up to date, or even correct. I do not work for any phone company, and therefore do not have access to internal telephone company literature. Moreover, there is very little material available in books or magazines which describes how U.S. telephone systems work. Much of the information in this article has been obtained piece-meal from many different sources such as books, popular magazines, computer data communications journals, handbooks, and sometimes just plain hearsay. I have tried to correlate as much as possible all the little bits and pieces into a coherent picture which makes sense, but there is no easy way to be sure of all the little details. So think of this article as if it is a historical novel – generally accurate and, regardless of whether it is completely true or not, fascinating.

With this out of the way, let's go on. Fig. 1 shows a simple diagram which explains how your home telephone fits into the overall picture. You, as the customer, are generally referred to as the "subscriber." Your telephone connects to the Central Office through a two-wire cable which may be miles long, and which may have a resistance on the order of hundreds or even thousands of Ohms. This cable is essentially a balanced line with a characteristic impedance of around 900 Ohms, but this varies greatly with different cables, different weather conditions, and different calls. (This is why it is so hard to keep a hybrid phone-patch balanced.)

The main power in the central office comes from 48 volt storage batteries which are constantly kept trickle-charged. This battery is connected to your line through a subscriber relay and a balanced audio transformer. The relay is sensitive enough to detect even quite small currents through your line.

The buttons which stick up out of your telephone case when you lift the handset actuate the hook switch. The name probably dates back to the days when the handset (or even earlier, the earpiece) hung on the side of the phone from a hook. In any case, when your phone is hung up it is said to be on the hook, and when you lift the handset to make a call it is said to go off the hook. With the phone on hook, the line is connected only to the bell (called the ringer). Because

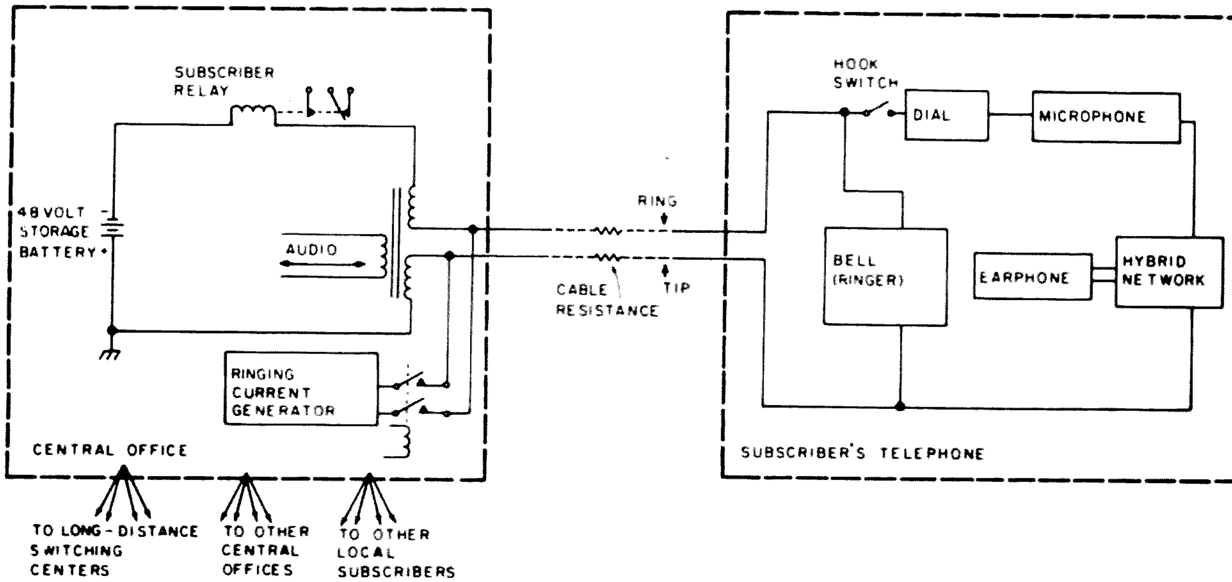


Fig. 1. Telephone block diagram.

the bell circuit has a capacitor in it, no dc current can flow through the phone. As a result, the subscriber relay back in the central office will be deenergized, indicating to the central office (let's abbreviate that as CO from now on) that your phone is hung up. Since there is no current through your line or phone, there is no voltage drop anywhere, and so if you measure the voltage across the phone line at your phone you will see the entire 48 volts (or even more if the CO batteries are well charged). The positive (grounded) lead is called the tip and negative lead is called the ring; these names correspond to the tip and ring of a three-circuit phone plug.

Now suppose you want to place a call. You pick up the handset, and the phone goes off the hook. This completes the dc circuit through the dial, microphone, and the hybrid network which is basically a complicated transformer circuit. At this point current starts to flow from the battery through your line and phone, and the subscriber relay back at the CO pulls in. The line voltage across your phone now drops to just a few volts because the line is loaded down by the low resistance of the phone. The CO now searches for some idle dialing circuits, and when it finds them, connects a dial tone back to your phone. When you hear this, you start dialing.

The dial shown in Fig. 1 is a rotary dial of the type which you turn with your finger (we will talk about Touchtone dials later). When you dial a number, the dial acts as a short circuit until you release the dial and let the built-in spring return it back to the resting position. As it is returning, it starts to open and close the circuit in sequence to indicate the number you dialed. If you dial a 1, it opens the circuit once; if you dial a 9 it opens the circuit nine times. As the dial is returning it causes the subscriber relay to open and close in step. This enables the CO to recognize the number you want. When you finish dialing, the dial becomes just a plain short circuit which passes current through the microphone and the hybrid network. Since the mike is a carbon unit, it needs this current to work.

When the CO receives the complete number, it starts to process your call. If you dialed another subscriber in the same area, it may connect you directly to that subscriber's line. Calls to phones a little further away may have to be routed through another CO, while long distance calls may go through one or more long distance switching centers (called tandems) and possibly many other CO's before arriving at the destination. At the completion of this process, you may get either a ringing signal, indicating that the phone at the other end is ringing, one of several types of busy signals, or possibly just silence, if something goes wrong somewhere.

When you talk to the person at the other end, the cable carries audio in both direc-

tions at the same time. Your carbon microphone varies the current in your circuit, and this current variation is detected by a balanced transformer in the CO. At the same time, audio coming back to your phone goes through the hybrid network to your earphone. (In phone company lingo they like to call the mike a transmitter, and the earphone is called the receiver.)

You may be interested in the makeup of the various tones you may hear on your telephone; these tones are important to people such as computer communications designers who have to build equipment which will recognize dial or other signalling tones:

Dial tone in older exchanges may still be a combination of 120 and 600 Hz, but the newer exchanges use a combination of 350 and 440 Hz. There is often a slight change in the dc line voltage at the beginning of dial tone, and this may also be detected.

Busy signal is a combination of 480 and 620 Hz which alternates for 1/2 second on and 1/2 second off (i.e., 60 interruptions per minute) when the party you are calling is busy. The same busy signal may be used for other conditions such as busy interoffice or long distance circuits, but would then be interrupted either 30 times a minute or 120 times per minute. This is a standard agreed on by an international telecommunications organization called CCITT (and I don't offhand remember the French words it stands for), but occasionally other frequencies up to 2 kHz are used. A siren-like sound varying between 200 and 400 Hz is often used for other error conditions.

The ringing tone, which you hear coming back to you when the phone rings on the other end of the connection, is nowadays mostly a combination of 440 and 480 Hz, but there is great variation between CO's. Very often a higher frequency such as 500 Hz is interrupted at 20 Hz, and other tones are used as well. The tone is usually on for 2 seconds and off for 4 seconds.

The ringing current, actually used to ring the bell in a telephone, is an ac voltage since it has to activate a ringer which has a capacitor in series with it. Different companies use different ringing currents, but the most common is 90 volts at 20 Hz. Since a typical phone may be thousands of feet away from the CO, the thin wires used may have a fairly high line resistance. Hence only a relatively small current can be applied to the bell, certainly not enough to ring something like a doorbell. This problem is solved by making the bell resonant mechanically at the ringing frequency so that even a fairly small amount of power is enough to start the striker moving hard enough to produce a loud sound. This is the reason why a low-frequency ac is used. Although this raises some problems in generating a 20 Hz signal at a high enough voltage, it has the advantage that a bell will respond to a ringing current only if the frequency is quite close to the bell's naturally resonant frequency. If you build two bells, one resonant at 20 Hz and the other resonant at 30 Hz, and connect them together to the same line, you can ring just one bell at a time by connecting a ringing current of the right frequency to the line; this has some useful applications in ringing just one phone on a party line.

Now let's look at some of the components of the phone itself. We will consider the most common new phone, a model 500 C/D manufactured by Western Electric and used by Bell System affiliated phone companies. This is the standard desk phone, having modern rounded lines and usually having a G1 or G3 handset. It was developed about 1950 and replaced the older 300-series phones which had the older F1 handset and had sharper corners and edges. (There was an inbetween phone, where they took an old 300-series phone and put a new case on it which resembled the 500-style case but had a straight up-and down back – the back of the case came straight down right behind the handset cradle, whereas the true 500-style telephone has what looks like a step sticking

It's ironic that the customer is charged extra for a service which not only costs the telephone company nothing, but even saves it money . . .

out behind the cradle). If you are still in doubt as to which phone you have, the bell loudness control is a wheel on the 500-type phone and a lever on the 300-type. If you live in the boondocks, you may still have the 200-type phone (sometimes called the oval-base) or maybe even the desk-stand type that looked like a candlestick, with the microphone mounted on the top and the earpiece hanging on the side from a hook. Neither of these phones had a built in bell, and so you probably have a bell box attached to your wall. (If you have a phone with a handle on the side which you crank to call the operator, the following does not apply to your phone!)

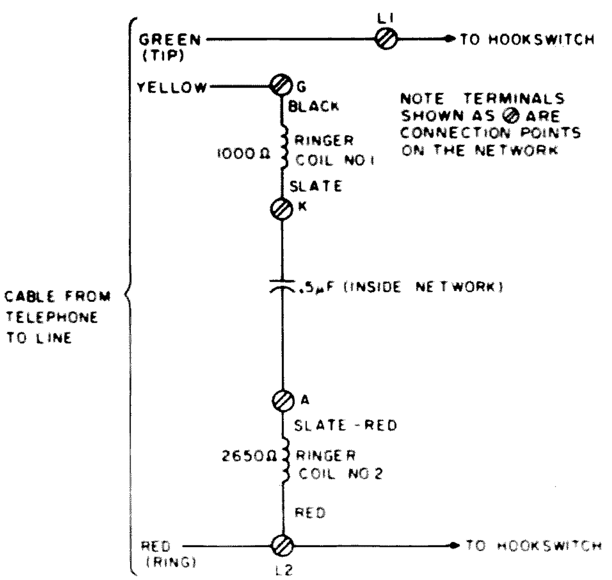


Fig. 2. Ringer connections inside 500 C/D telephone set.

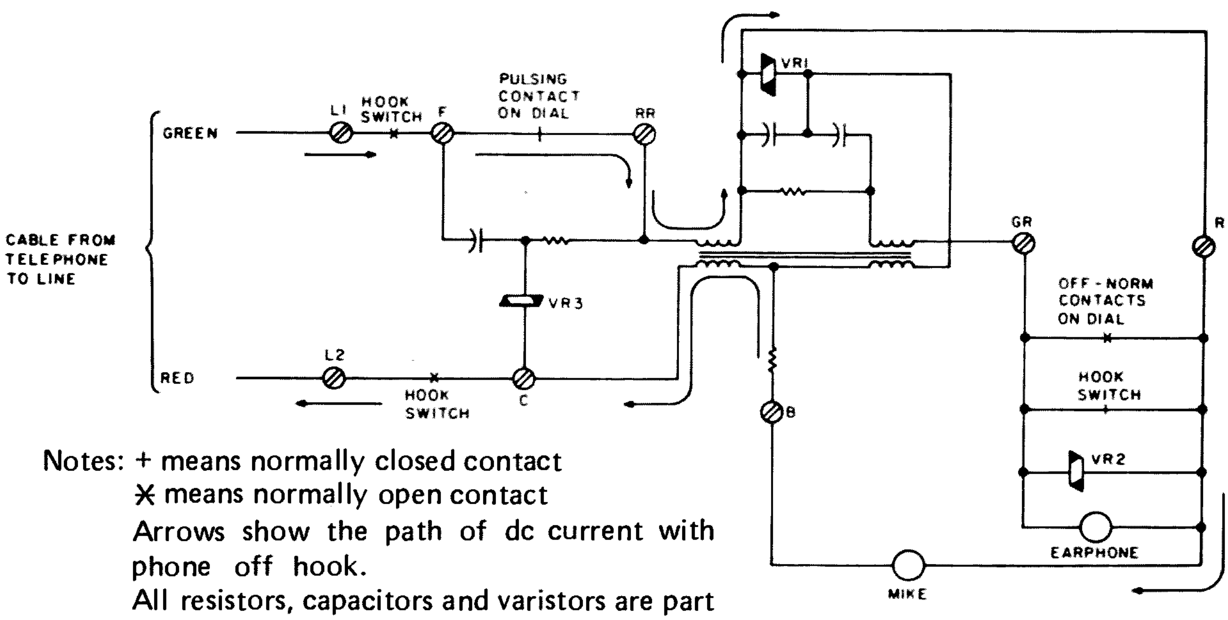
Fig. 2 shows the bell circuit, which consists of a two-coil ringer and a 0.5 uF capacitor. On Western Electric phones the capacitor is mounted inside the network assembly, which also has a large number of screws on top which act as connection points for almost everything inside the phone. (I have never been able to find out why the ringer has two coils of unequal resistance, but it apparently has something to do with determining which subscriber on a party line makes which call.) In most phones, the yellow and the green wires are connected together at the wall terminal block so that the bell is connected directly across the telephone line; disconnecting the yellow lead would turn off the bell (although sometimes the connection is made internally by connecting the black lead from the ringer directly to the L1 terminal, in which case the yellow lead is disconnected.

You may wonder why a yellow lead is needed at all when only two wires are normally used anyway. It is true that only two wires enter the house from the outside; one of. these is the tip and the other is the ring. In a non-party line the ringing current as well as all talk voltages are applied between the tip and the ring, and it doesn't actually matter which of the phone leads goes to the tip and which to the ring if you have a rotary dial phone. If you have a Touchtone dial, then you have to observe polarity so that the transistor circuit in the dial works, in which case you have to make sure that the green lead goes to the tip and the red lead goes to the ring.

The yellow lead is commonly used for party lines. On a two-party line ringing current from the CO is applied not between the two lines, but between one line and ground. In that case the yellow lead goes to ground while the other side of the ringer (the red lead) is connected to either the tip or the ring, depending on the party. In this way, it is possible to ring only one party's bell at a time.

The remaining connections inside the telephone are shown in Fig. 3. The components labeled VR are varistors: the phone companies must be the world's biggest users of these devices, which are variable resistors whose resistance drops as the voltage across them rises. Their function in the phone set is to short out parts of the set if the applied voltage gets too high. For instance, VR2 is connected directly across the earphone (receiver) and acts as a volume limiter to lower the volume if the applied voltage gets too high — a great way to protect your eardrums.

As you can see in Fig. 3 we use the standard phone company way of identifying normally open and normally closed switches — an X in a wire is a normally open contact of a switch or relay, while a short bar.means a normally closed contact. The arrows in the drawing show the path of dc current through the phone when it was off the hook. Starting



Notes: + means normally closed contact
✕ means normally open contact
Arrows show the path of dc current with phone off hook.
All resistors, capacitors and varistors are part of the 425E network.

Fig. 3. Interior connections of 500 C/D telephone set.

at the green wire, the current path goes through a set of contacts on the hook switch, then through the pulsing contacts on the dial, through part of the network, through the mike, back through a second winding on the network, and finally through a second contact on the hook switch and back out to the red wire.

The hook switch actually has three sets of contacts, two normally open (open, that is, when the hand set is on hook) which completes the dc circuit when you pick up the handset, and a normally closed contact which is wired directly across the earphone. This contact's function is to short the earphone during the time that the dc circuit is being opened or closed through the phone – this prevents you from being blasted by a loud click in the earphone.

The dial has two contacts. One of these is the pulsing contact, which is normally closed and only opens during dialing on the return path of the dial after you let go of it. The second contact, labelled the off-normal contact, shorts the earphone as soon as you start turning the dial, and releases the short only after the dial returns back to the normal position. In this way you do not hear the clicking of the dial in the phone as you dial.

Finally, the phone has the hybrid network which consists of a four-winding transformer and a whole collection of resistors, capacitors, and varistors. The main function of the network is to attenuate your own voice to lower its volume in your earphone. The simplest phone you could build would be just a series circuit consisting of a dial, a mike, and an earphone. But the signals coming back from the other party are so much weaker than your own signals, that an earphone sensitive enough to reproduce clearly and loudly the voice of the other person would then blast your eardrums with the sound of your own voice. The function of the network is to partially cancel out the signal produced by the local mike, while permitting all of the received signal to go to the earphone. This technique is similar to the use of a hybrid phone patch with a VOX circuit, where you want the voice of the party on the telephone to go to your transmitter, but want to keep the receiver signal out of the transmitter.

In addition to the parts needed for the hybrid, the network also contains a few other components (such as the RC network across the dial pulsing contacts) and screw-type connection points for the entire phone.

A Touchtone phone is similar to the dial phone shown here, except that the rotary dial is replaced by a Touchtone dial. In addition to its transistorized tone generator, the standard Touchtone pad has the same switch contacts to mute the earphone, except that instead of completely shorting the earphone, as the rotary dial does, the

Touchtone dial switches in a resistor which only partially mutes the phone. The circuit of the Touchtone dial is shown in recent editions of the ARRL Handbook so we won't reprint it here, but Fig. 4 shows two possible connections of such dials for amateur use. Fig. 4 (a) shows the connection for coupling the dial output electrically to a transmitter input, while Fig. 4 (b) shows how to connect it to a 500 Ohm earphone (such as the earphone from a telephone handset) for acoustic coupling into a transmitter microphone. Fig. 5 shows how the terminals on a Trimline Touchtone pad correspond to the colored wires coming from the standard desk-type phone pad.

It is fairly common knowledge as to what frequencies are used for Touchtone signalling, but a misprint in several recent ARRL publications gives the wrong frequency for one of the high tones, so here is a short table which repeats the correct numbers:

LOW TONE GROUP (HZ)	HIGH TONE GROUP (HZ) 1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Each digit is composed of one frequency from the low group and one frequency from the high group; for instance, the digit 6 is generated by producing a low tone of 770 Hz and a high tone of 1477 Hz at the same time. The American Touchtone pads generate both of these tones with the same transistor, while European pads (yes, there are some) use two transistors, one for each tone. In addition to the first three high tones, a fourth tone of 1633 has been decided on for generating four more combinations, called A through D in the above table. These are not presently in use, although the standard phone Touchtone pad can easily be modified to produce this tone, since the required tap on the inductor used to generate the tone is already present and only an additional switch contact is needed to use it; information on this simple conversion is found in the 73 publication *Digital Control of Repeaters.*

What is not generally known is that the U.S. Air Force uses a different set of Touchtone frequencies, in the range of 1020 to 1980 Hz. Since many of the phones available for purchase in stores come from Department of Defense surplus sales, it will be interesting when these phones become available.

Another Touchtone dial presently used by amateurs is made up from a thin elastomeric switch pad made by the Chomerics Corp. (77 Dragon Court, Woburn, Mass. 01801) and a thick-film hybrid IC made by Microsystems International (800 Dorchester Boulevard, Montreal, Quebec). The pad is the Chomerics ER-20071, which measures about 2¼ inch wide by 3 inches high, and only about 3/16 inch thick (Chomerics also makes a smaller model ER21289, but it is very difficult to use and also apparently unreliable). Microsystems International makes several very similar ICs in the ME8900 series, which use different amounts of power and generate different amounts of audio. Some of these also contain protection diodes to avoid problems if you use the wrong polarity on the IC, and there are so many models to choose from that you should get the technical data from the manufacturer before ordering one. There are a number of US distributors, including Newark Electronics, Milgray and Arrow Electronics in New York. KA Electronics Sales advertised both the pad and the IC in the July 1974 issue of 73 Magazine. In single quantities, the pad goes for about $9 and the IC costs about $18, although it drops in price if you order larger quantities.

A simple circuit for the IC and pad is

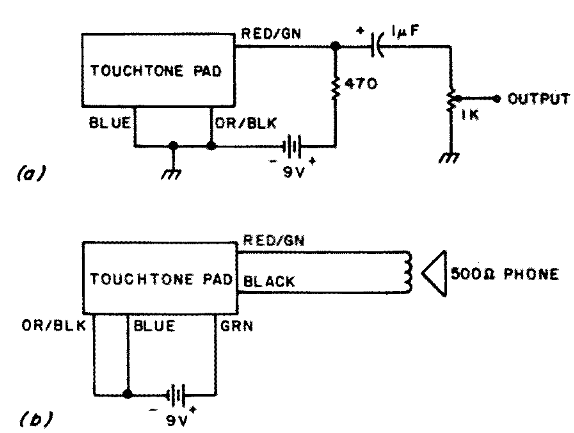


Fig. 4. Touchtone pad connections.

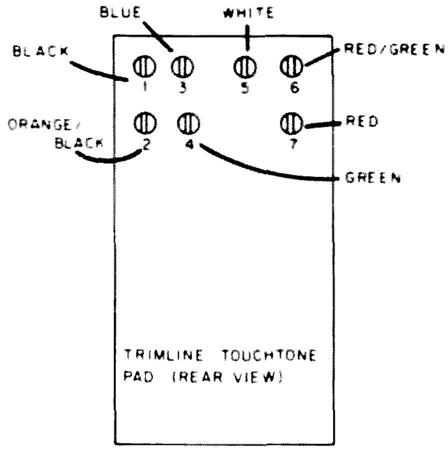


Fig. 5. Trimline Touchtone pad connections.

shown in the ARRL publication *FM and Repeaters for the Radio Amateur.* While this circuit is perfectly good, it does not work in the presence of strong rf. If you want to mount this pad and IC on a portable 2-meter rig, you will have to use bypass capacitors and chokes to keep the rf out of the IC. Bypass pins 8 and 16 of the IC to pin 13 with small discs of about 0.001 or 0.01 μF, right at the IC, using very short leads. Then put small 2 to 5 microhenry chokes in series with pins 8, 13 and 16 right at the IC. If needed, put more chokes at the other end of each lead. Ohmite Z-144 chokes are good but a little bulky; the small 1.8 microhenry chokes used in Motorola Handie-Talkies (Motorola type 24-82723HO1) are about the size of a 1/8-watt resistor and almost as good. It may seem a little funny to put chokes in the ground lead, as all hams are trained to use good rf grounds, but the object is to keep rf out of the IC at all costs and this accomplishes that by letting the IC float above ground if needed, but removing any rf voltage which might appear across the IC leads. It is also possible to generate the Touchtone tones with separate oscillators or with IC oscillators (such as the NE566), as is done in pads sold by Data Engineering. This system may not be as stable or accurate as other systems, though.

One of the problems with any current IC oscillator is that the frequency changes if rf gets near it. Many hams are having a hard time mounting such IC pads on their 2-meter Handie-Talkies. But a solution seems in sight – Mostek, a large IC company, is coming out with an IC Touchtone generator which has a cheap 3.58 MHz external crystal as reference, and then produces the tone frequencies by dividing the 3.58 MHz down with flip flops to get the required tone frequencies. This approach not only promises to be more reliable in the presence of rf, but should also be cheaper since it would not need the custom (and expensive) laser trimming of components that the Microsystems International IC needs to adjust the frequencies within tolerance.

At the other end of the telephone circuit, in the CO, various circuits are used to decode the digit you dial into the appropriate signals needed to perform the actual connection. In dial systems, this decoding is done by relay circuits, such as steppers. This circuitry is designed for dialing at the rate of 10 pulses per second, with a duty cycle of about 60% open, 40% closed. The minimum time between digits is about 600 milliseconds, although a slightly greater time between digits is safer since it avoids errors. In practice, many COs will accept dialing at substantially slower or faster rates, and often you will see a dial that has been speeded up by changing the mechanical governor to operate almost twice as fast; it depends on the type of CO equipment.

Touchtone decoding is usually done by filter circuits which separate out the Touchtone tones by filters and then use a transistor circuit to operate a relay. A common decoder is the 247B, which is designed for use in small dial switchboard systems of the type that would be installed on the premises of a business for local communication between extensions. It consists of a limiter amplifier, seven filters and relay drivers (one for each of the seven tones commonly used) and some timing and checking circuitry. Each of the seven relays has multiple contacts, which are then connected in various series/parallel combinations to provide a grounding of one of ten output contacts, when a digit is received. The standard 247B does not recognize the * and # digits, but can be modified easily enough if you have the unit diagram.

The 247B decoder is not very selective, and can easily be triggered by voice unless some additional timing circuits are connected at the output to require that the

relay closure exceed some minimum time interval before it is accepted. Slightly more complicated decoders which have the time delays built in are the A3-type and the C-type Touchtone Receivers. Both of these are used in customer-owned automatic switchboards when a caller from the outside (via the telephone company) wants to be able to dial directly into the private switchboard to call a specific extension. The C-type unit is similar to the 247B in that it has ten outputs one for each digit. The A3-type does not have output relays, but instead has seven voltage outputs, one for each of the seven basic tones, for activating external 48-volt relays. The A-3 unit is ideal for activating a Touchtone encoder, which can then be used to regenerate the touchtone digits if the original input is noisy. This might be very useful in a repeater autopatch, for cleaning up Touchtone digits before they are sent into the telephone system.

In addition to the above, there are probably other types of units specially designed for use in the CO, but information on these is not readily available. It is also fairly easy to build a Touchtone decoder from scratch. Though the standard telephone company decoders all use filter circuits, it is much easier (though perhaps not as reliable) to use NE567 phase-locked-loop integrated circuits.

An interesting sidelight to Touchtone operation is that it greatly speeds up the process of placing a call. With a Touchtone dial it is possible to dial a call perhaps 3 to 5 times faster than with a rotary dial. Since the CO equipment which receives and decodes the number is only needed on your line during the dialing time, this means that this equipment can be switched off your line sooner and can therefore handle more calls. In fact, the entire Touchtone system was invented so that CO operation would be streamlined and less equipment would be needed for handling calls. It is ironic that the customer should be charged extra for a service which not only costs the telephone company nothing, but even saves it money.

Another practice which may or may not cost the company money is the connection of privately-owned extension phones. You have probably seen these sold by mail order houses and local stores. The telephone companies claim that connecting these phones to their lines robs them of revenue and also may cause damage to their equipment. There are others, of course, who hold the opinion that the easy availability of extensions only causes people to make more calls since they are more convenient, and that the companies really benefit from such use. The question of damage to equipment is also not easily answered, since most of the extension phones are directly compatible, and in many cases the same type as the telephone company itself uses. Be that as it may, this may be a good time to discuss such use.

Prior to an FCC decision on telephone company interconnection in the Carterfone case in 1968, all telephone companies claimed that the connection of any equipment to their lines was illegal. This was a slight misstatement as no specific laws against such use were on the books. Instead, each local telephone company had to file a tariff with the public service commission in that state, and one of the provisions of that tariff was that no connection of any external equipment was allowed. By its approval of that tariff, the public service commission gave a sort of implicit legal status to the prohibition.

How strange that some companies allow interconnection of customer equipment without any hassle at all, while others make things quite difficult . . .

In the Carterfone case, however, the FCC ruled that the connection of outside equipment had to be allowed. The phone companies then relaxed their tariff wording such that connection of outside equipment was allowed if this connection was through a connecting arrangement *provided by the telephone company* for the purpose of protecting its equipment from damage. Although this result has been challenged in several states, that seems to be the present status. The strange thing is that some telephone companies allow interconnection of customer equipment without any hassle whatsoever, while others really make things difficult for the customer.

. . . WHIPPLE

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THE IDENTALERT

Not too long ago, the author decried the inability of the ham to home brew his equipment, particularly solid-state designs, due to the difficulty in obtaining small quantities of transistors and integrated circuits. Leave it to the hams though! Now it is not only possible to obtain these devices via mail order but the prices have dropped to a point where it makes it worthwhile to experiment with these devices.

The Identalert is the result of the author's desire to experiment with some TTL integrated circuits. (The "Century Digital Clock" used RTL IC's.) This remarkably accurate unit emits a beep every ten minutes and will do so as long as power is applied. No circuit that uses a unijunction transistor for timing long periods of time can attain the accuracy or repeatability of digitally derived timers.

Included in the unit is an option to switch to a lamp to annunciate the ident mark for use when rag chewing late at night to avoid disturbing others. The Identalert is all solid state (except for the lamp which will last two hundred times its rated life) therefore its accuracy will remain high indefinitely.

Hard wiring is used to interconnect circuitry; this is #24 solderable insulation wire (polyurethane insulation), available in parts stores such as Beldsol, Analac, Soldereze. For the home brewer it is completely practical to use punch board rather than go through the time and trouble to lay out, fabricate and drill a single PC board.

Circuit Description

Q2, Q3 divide the 60 Hz line frequency by 60 to give us an accurate 1 pulse per second. Q1 is a pulse stretching Schmitt trigger which shapes the attenuated line voltage to within the constraints of the IC's. Q4, Q5, Q6 count these pulses. We are looking for a count of 600 (seconds). In actuality, the signal starts its beep at 598 seconds and continues for two seconds; then the counters are reset to zero to start counting over again. The outputs from Q5, Q6 are in the form of a binary coded decimal which must be converted to the decimal system. This is accomplished in Q7, Q8. The desired outputs of Q7, Q8 are in the form of "zeroes" or low voltage. The chosen-time recognition gate, Q13, requires "ones" or high voltage (prox. 3.5V) therefore Q12, six inverters in one IC, is used for the transformation. Two of the inverters in Q12 are used as inverter-buffers to provide cleaned up pulses of proper polarity to operate the reset and timed annunciator circuitry. These pulses are obtained from Q12-12 and Q12-8. The decoded outputs of Q12 are connected

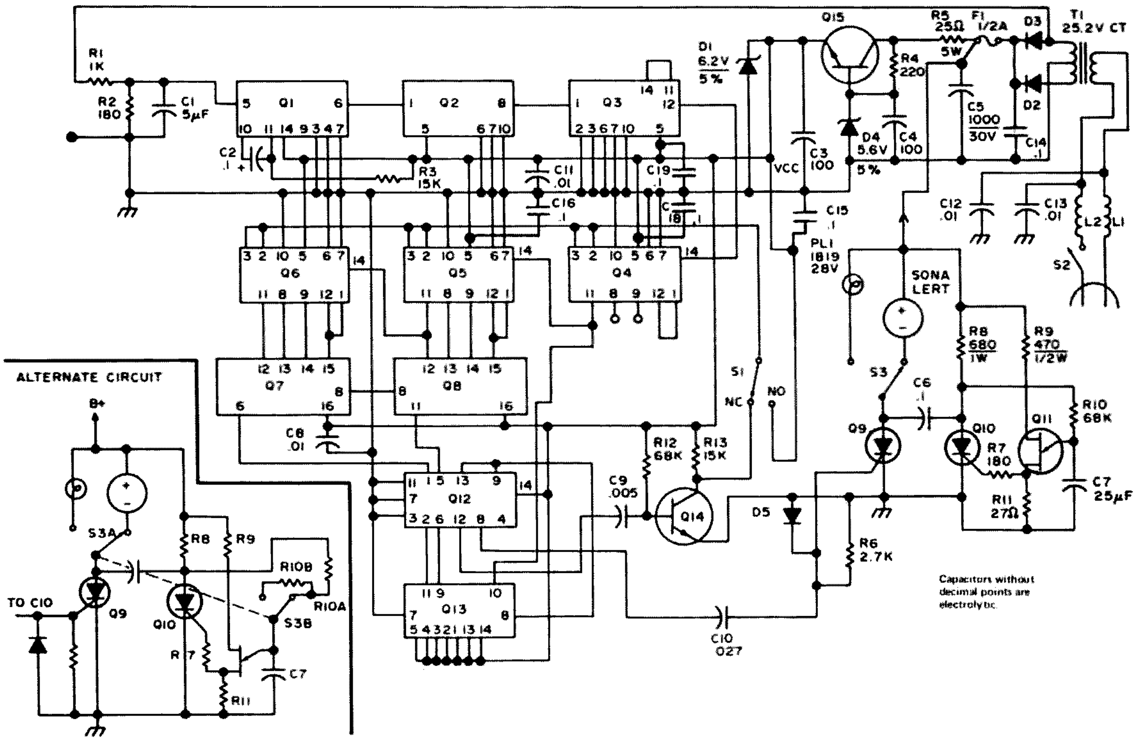

Fig. 1.

to Q13, one half of a dual triple-input NAND gate. You will note that the output of BCD 8 from Q4-11, the least significant digit, is connected directly to one of the inputs of the triple-input NAND gate because its desired output is in the form of a "one". When all the inputs to Q13 are "ones" or high – and only then – the output of that gate will go low (otherwise it remains a "one").

The timed annunciator circuit requires a positive going pulse to trigger Q9, a SCR which is in the off state. When Q12-8 goes from "zero" to "one" the charge across C10 follows it, causing Q9 to turn on and allows current to flow through the Sonalert. When a SCR turns on, the voltage at its anode goes to a low state. The charge across C6 follows this abrupt drop at the anode of Q9, resulting in a negative going voltage spike at the anode of Q10 which turns Q10 off. The voltage at the anode goes high (prox. 16V). This voltage is applied to the charging resistor R10 which generates a charging current into C7 which determines the length of time that the Sonalert will remain on. When the charging voltage across C7 reaches approximately 11 volts the unijunction fires and the resulting pulse across R11 is fed into the gate of Q10 via R7. This turns Q10 *on*. The voltage at the anode of Q10 drops abruptly to almost zero volts; charging voltage and current cease to be. The voltage across C6, which is called a commutating capacitor, follows the same sequence of events as before–except in reverse–turns off Q9. Therefore the Sonalert stops sounding.

As there is usually a great disparity between actual capacitance and the capacitance marked on the case of an electrolytic, you may have to use a different value of resistance for R10 than that noted in the parts list. With the particular electrolytic the author used and R10 as specified, the signal – both beep and light – remained on for two seconds which is optimum for the beep. When R10 was increased to 100K, the signal remained on for 6 seconds. An alternate circuit is shown for those of you that would like to have the lamp on for a longer time than the beeper. This may be advisable so that the visual signal is more obvious. You can leave out the lamp circuit altogether by connecting the minus terminal of the Sonalert directly to the anode of Q9.

Getting back to the main circuit, we must reset the counting circuits to zero at the end of our count period so that we can start over from the same point again and again. This is accomplished via Q14 which operates as an inverter-buffer. It is nothing more than a silicon NPN switching transistor that requires a negative pulse at its base to accomplish its task. C9 acts as a commutating capacitor in that there is a finite time that Q4-11 remains a logical one after triggering Q9 on. When Q4-11 goes in the negative direction it causes a negative pulse to appear at the base of Q14 via Q13 and Q12-12, turning it off. The collector of Q14 goes to about 5 volts which is fed to the reset gates of Q4, Q5, Q6 – making all the outputs of these ICs go to zero. We have completed the cycle!

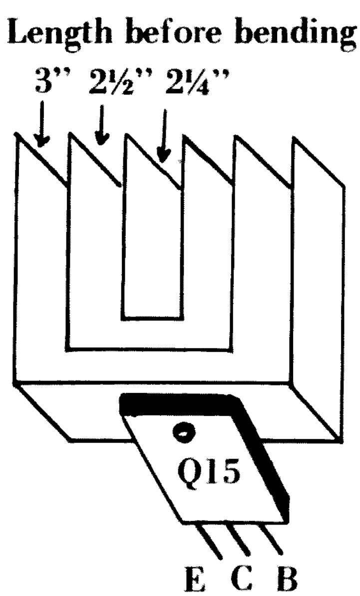

Fig. 2.

The simple but adequate power supply, with acceptable ripple and good regulation, provides all the voltages necessary to operate the unit. Zener diode, D1, acts as a simple overvoltage protection device. Don't leave it out! Should Q15 short, Vcc will become high enough to make the lives of the integrated circuits very short indeed. With D1 in the circuit, if the voltage rises above the zener breakdown point of the particular device installed, the fuse will blow before any damage can be done to the ICs.

Q15 must be attached to a heat sink. Either a commercial device can be used such as IERC PA2 or Thermalloy 6106; or the device can be properly mounted to the chassis using the mica washer and silicone grease; or you can fabricate a heat sink from strips of .062 aluminum 3/8" wide (Fig. 2). The strips can be bent in a vise or with pliers, drilled to clear a #4 screw and sprayed black. Spread a little silicone grease between each formed strip then attach the transistor to the assembly using the mica washer and the grease and tighten the whole assembly together firmly with a #4 screw and nut and the Belleville washer that comes with the transistor. Be sure that the voltage at the emitter of Q15 does not exceed 5.5 volts *before* you connect it to the Vcc buss. The IC circuitry draws 250 mA at 5 volts.

You may or may not require the low pass filter installed in the 117 vac line. Some of the appliances plugged into the same line as the Identalert caused inadvertent zeroing of Q4, Q5, Q6. In no case did any of the author's amateur radio equipment being turned on or off introduce transients into the Identalert.

Other than waiting for many 10 minute intervals to pass, which can be tedious, the fastest way to check out the Identalert is with an audio oscillator feeding directly in Q1-5. Unless you have a high power oscillator remove C1 and R2 from the signal path (lift ground end of these components temporarily). Under this condition all that is required is a signal of 1 v rms. To check short term (several hours) accuracy of the timer an electric clock is fine but I have found that the long term accuracy of several new and old electric clocks I have leaves something to be desired. The fact remains, though, that if your connections are correct as per schematic you must get the proper timing. There are no device or temperature limited parameters involved in this circuit.

Operating the unit is simplicity itself. Apply power to the unit via S2, press S1. When S1 is released the timing cycle starts. That's all there is to it; no warmup, no waiting for easily remembered time marks, no fuss!

IDENTALERT PARTS LIST

Q1	SN 74121 IC
Q2	SN 7492 IC
Q3, Q4, Q5, Q6	SN 7490 IC
Q7, Q8	SN 7442 IC
Q9, Q10	2N5060 SCR HEP R1001
Q11	2N4870 Unijunction HEP 310
Q12	SN 7404 IC
Q13	SN 7410 IC
Q14	2N706 Silicon switching transistor or equal HEP 50
Q15	MJE 520 HEP 245
D1	6.2 V 10% zener 1N5234A HEP Z0214
D2, D3	1N4001 silicon rectifier 50 PIV 1 A HEP 154
D4	1N5232B 5.6 V 5% zener HEP 603
D5	1N34 germanium diode or equal
	Sonarlert SC 628-Mallory
F1	½ A fuse
T1	Transformer 25.2 V C.T. Stancor P8180
R1	1K ¼ W 10%
R2, R7	180 ¼ W 10%
R3, R13	15K ¼ W 10%
R4	220 ¼ W 10%
R5	25 5 W 10%
R6	2.7K ¼ W 10%
R8	680 1 W 10%
R9	470 ½ W 10%
R10, R12	68K ¼ W 10%
R10A	68K ¼ W 10% for alternate
R10B	39K ¼ W 10% for alternate
R11	27 ¼ W 10%
C1	5 uF @ 10 V
C2, C6	0.1/100 V Mylar
C3, C4	100 uF @ 15 V
C5	1000 uF @ 25 V
C7	25 uF @ 15 V see text
C8, C11, C12, C13, C14, C15 C16, C17, C18, C19	discap 0.1
C9	0.005 mylar
C10	0.027 mylar
S1	SPDT push-button switch
S2	SPDT
S3	SPDT slide or toggle (use DPDT for alternate ckt)
PL1	Lamp 28 V @ 40 mA (CM22-02-05-11 or equal—Chicago Miniature) or 1819 lamp
L1, L2	2 uhy choke (25T #22 wire, ¼ in. I.D.

. . . K2PMA

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Try Attaché Case Mobile

By now you have most probably been advised by your friendly automobile insurance company that they will no longer freely dole out reimbursement checks for the bolt-in cartridge stereo tape machines which have become so popular recently. It seems these machines have the uncanny ability to unbolt themselves and float away. Likewise for the 10-4 gear and ham rigs (which all look alike to some purloining eyes).

Amateur mobile equipment, in keeping up with advancing technology (solid-state FM rigs for example), are no longer 50 pounds of trunk mounted transformer iron. Also, many transceivers are capable of operating either from a 120V ac source or the 12V mobile battery.

Therefore, when leaving your car, why not carry your rig with you. . .and eliminate the possibility of having it "ripped off?" One method of doing this, as shown in the photograph, is to bolt the equipment into an attache' case. (Most executives carry such a case only to impress their neighbors or inflate their own egos, while actually the contents consist of a ham sandwich and a Playboy magazine.) Power and antenna connections are made via appropriate plugs mounted on the bottom or end of the case. And. . .don't be afraid to drill holes in your nice expensive conveyance. After all, it is being put to yeomanly duty as attractive protection for many hundreds of dollars worth of equipment.

. . . W3WTO

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TWO METERING A HUSTLER

It all started when I decided to increase my simplex channel 2 meter coverage as well as improve repeater performance in some of the marginal areas. The 19 inch quarter wave whip on top of the station wagon had to go, but what should replace it?

The problem was, the ¼λ whip just cleared the garage entrance and a 5/8λ antenna would have all kinds of problems in getting through. A midnight homecoming would hardly go unnoticed, as the whip clunks along the raised overhead garage door. The thoughts of unscrewing the 5/8λ antenna each morning and night to get the car into and out of the garage left me cold.

After several weeks of cogitation, the thought occurred: Why not devise a 2 meter antenna that folded over like the lower frequency 10 through 80 meter mobile antennas? Having a "low band" Hustler, I decided to see what could be done with it.

Folding over the low band Hustler to get the car into and out of the garage is no big deal, it takes about five seconds and I have been doing it for years.

The challenge, of course, was in figuring out how to adapt the Hustler for 2 meters and at the same time, have it available for low band operation. There are many of us who still like to operate the lower fre-

quencies, especially on long trips.

The solution that I arrived at was to convert the Hustler to a "J" match for 2 meters as shown in Fig. 1, and add a half wave radiator in place of the low frequency loading coil. The adaptation is simple and can be accomplished in several hours. The cost will vary from nothing if you have a good junk box, to under $10.00.

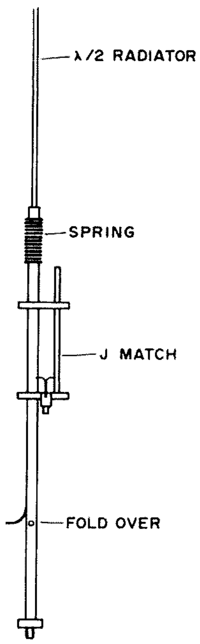

Fig. 1.

The coil spring is a good investment in any event. It is desirable for use with the 40 and 80 meter loading coils and essential for use on 2 meters. The length of these antennas is such that tree branches will occasionally be struck at high speeds and the impact can be destructive unless the coil spring is used.

The 2 meter antenna has been designed to be just a few inches shorter than the 80 meter radiator. The objective is to develop as much height as possible for the 2m antenna and a good place to stop is at a point equal to the longest low frequency antenna.

Also, moving the J match any higher could get it too close to the loading coil and affect low frequency operation. Any VHF addict recognizes that antenna height is a very important parameter, and this antenna is designed to achieve maximum height for mobile operation. If anyone objects, the antenna can be made any length shorter by sliding the J match down to a lower point on the Hustler mast and cutting the top section so that it is ½ wavelength (38") above the J matching section.

The top section is a 6, 10 or 11 meter whip cut down to 33½" and terminating in a 3/8-24 threaded stud. There is a slight problem in connecting it to the coil spring because it also terminates in a 3/8-24 threaded stud. A 1" long adapter with a 3/8-24 female thread provides the connection. The one in my junk box was purchased from a radio store several years ago but I haven't seen them listed lately.

In the worst case, any machine shop can easily make one for you out of 1" diameter aluminum stock or buy the drill and tap and do it yourself. The 19¼" J bar is 3/8" outer diameter aluminum obtained from an old TV antenna. The bottom of the J bar is grounded to the Hustler mast via the aluminum strip. A similar strip made out of plastic near the top of the J match is used to keep the J bar from vibrating. Clamps are fabricated out of 1/16" thick and 1/2" wide aluminum to fasten the J bars to the horizontal strips as shown in the detailed drawing Fig. 2.

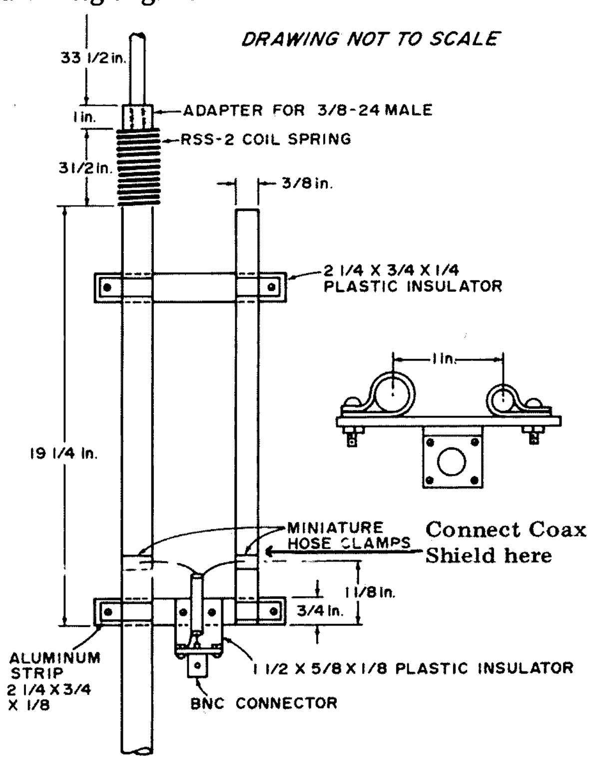

Fig. 2.

A quick disconnect BNC chassis mounting type connector has to be mounted on the shorting strip and insulated from it. This is accomplished with the 1¼" x 5/8" x 1/8" piece of plastic. A 3/4" x 3/4" piece of angle

aluminum holds the BNC connector on the plastic insulator. Be certain that the connector is not shorted to ground or you will have trouble getting the SWR below 1½ to 1.

RG58U interconnects the BNC to the tap points on the J match. Drilled holes and self-tapping screws could be used to attach the coax but I preferred using very small size hose clamps. The dimensions given should result in a low SWR. With some fine adjusting I have been able to bring my SWR down to 1.1 to 1.

All of the small hardware and coax connection points should be coated with RTV or similar material to prevent the inevitable corrosion that occurs with time and bad weather.

The gain of the antenna compared to the ¼λ whip is a significant 4 to 6 dB except at one point where it drops to 2 dB. The radiation pattern is shown in Fig. 3, and was taken by rotating the auto in an open field four miles away from the home base receiver. A precision attenuator was used to make the measurements. Two to 3 dB of the gain is derived from the ½λ versus the ¼λ radiator and the remainder from the greater antenna height.

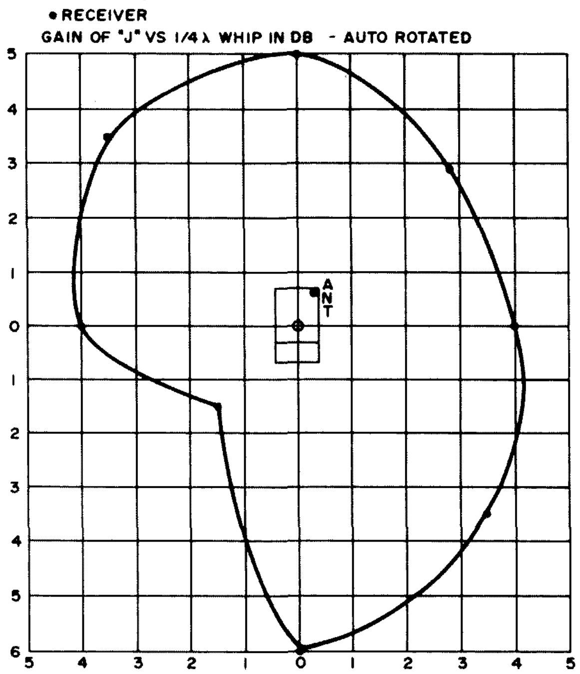

Fig. 3.

The unsymmetrical radiation pattern occurs because the Hustler is at the extreme end of the vehicle and because there is some radiation from the J match. Rotating the J match alone produces a 2 dB variation in signal. It should be possible to rotate the J match to produce a more symmetrical pattern but this was not tried.

For esthetic reasons and to keep the wind resistance down, the J match was oriented in line with the direction of motion of the car, thus the antenna appears as a single element when observed from the front or rear. When viewed from the side, it can generate some interesting comments.

There is one negative aspect to this antenna. It does require a separate RG58U coax feedline to connect to the J match for 2 meter operation. I was not able to think of a simple way to utilize a common coax for both low and high frequency operation without too much compromise. I'll leave this potential improvement as a challenge to the reader.

Meanwhile I run my 2 meter coax under the car, up between the car body and the bumper, along the inside of the tail light and up the Hustler mast. Plastic clips, or vinyl tape holds the coax to the mast. There is the option to run the coax inside the car and mount a BNC connector just an inch or two from the antenna ball mount. Then, just a shorter piece of coax will be visible running up the mast.

The switch from high to low frequency operation is quite simple and takes only ten seconds. Remove the 2 meter top section and replace it with the appropriate low frequency loading coil and radiator. Disconnect the 2 meter coax at the J match and move it away from the mast. Coil it out of the way. The J match is left untouched.

To go from low frequency operation to high, follow the procedure in reverse. Since you can't operate 2 transmitters simultaneously, 10 seconds is a small price to pay for having one convertible antenna and is little more effort than changing low frequency band operation.

The effects of leaving the J match in place for low frequency operation are immeasurable. The resonant frequencies and SWR's did not change by any measurable amount on an 80 and 20 meter test. This is readily understandable when you consider that on low frequencies, the 19" J bar is in parallel with the mast and sufficiently

spaced from the loading coil to have no capacitive effect.

The results on 2 meters have been gratifying. My simplex channel buddy reports that he no longer loses me on the way to work in the morning. On weaker signals, flipping back and forth between the ¼λ whip and the J makes the difference between hearing them and not.

What is presented here is not original by any means. The J antenna has been around for many years. What is new is the adaptation to an existing product which many of us already own. The same concept could undoubtedly be applied to other manufacturers' low frequency mobile antennas. It's nice to be able to put out a solid signal and get the car into the garage too!

. . .W3HTF

Bill Pasternak WA6ITF
Associate Editor

Can Those Split-Split Channels Work?

It's needless to say that Two Meter FM is the hottest thing to hit the amateur radio world since the advent of SSB. In large urban areas, such as New York, Boston, San Francisco and Los Angeles, the growth pattern is easy to follow: Just listen to the number of new callsigns appearing daily on your local repeaters. Newcomers, Old-Timers and everyone in between are buying Two Meter radios and getting their share of the "Fun Mode." In some areas the overcrowding is getting to the point where the local Repeater Councils are being put into the position of reassessing the band-plan/activity amount ratio in order to find a way to sanction new repeater systems. One of the solutions being seriously considered is the split-split or 15 kHz separation repeater.

Before going any further, it may be best to explain what a split-split repeater is and where the term comes from. In the days before the national adoption of what is known as the Modified Texas Plan, areas that had some form of standardization used channels that were 60 kHz from one another with 600 kHz spacing between input and output. As the need for more channels grew, along with the need for some form of national standardization, the 60 kHz channels were "split" and we now had twice the number of available channels, separated by 30 kHz and still retaining the 600 kHz separation between input and output. For the past two years this has more than supplied the needs of most cities — even one as large as Los Angeles. However, it is apparent that no leveling off point for the number of amateurs coming to two is in sight, and as their numbers increase so do the demands for new repeaters. Again, the most logical approach you might think would be to again "split" from 30 kHz to 15 kHz separation between systems, and again double the number of channels. You do not need an electronic calculator to do the math on that one. But hold it! Is splitting again the best solution? While I do not claim to be an expert on the subject of split-split repeater systems, I suspect that I might be a bit more familiar with the pitfalls that may appear when such a system is being put on the air — since I had the dubious honor of being the first to try such (along with my good buddy Larry Levy and the rest of the Kings County Repeater Association). For better or worse this is the story of WA2ZWP, how it got started, why we wound up on a split-split channel and, most important, what we learned in the process.

WR2ACV, as it is now known in New York City FM circles, began about 2 am one cold January morning in 1970. Even the original members of the KCRA are probably not aware of that. Larry and I had been putting in some long hours in our TV service business and had stopped on our way home to grab a late-night snack before going forth to grab forty winks. We were both very active on the WA2SUR system (now WR2AAA) but with SUR's phenomenal growth it was getting hard to keep a QSO of any length going with ourselves or our friends. That evening Larry suggested that he and I put up our own repeater; we discussed the possibilities with regard to our available time, shrugged, and for the moment shelved the idea. Though we discussed the matter from time to time over the next eight months, it was not until Larry had interested a number of other amateurs and (through one of them) procured a site that the KCRA was officially formed and work begun on the machine. During that time the Northeast Repeater Association had been formed and by the time our group approached them for an allocation, all standard 30 kHz split channels had been assigned. We were left with the alternative of accepting a split-split channel pair or scrapping the whole project. We elected to go with what we could get, and that turned out to be 146.205 in, 146.805 out. In May '71, after a month of part-time on the air smoke testing (and that term is in no way used loosely) ZWP went into full operation and we started to learn a lot about the world of split-split systems — from both the owner and the user standpoint.

In regard to the latter, those of us using converted two-way commercial equipment found little or no problem using the system. About half of us were running mobile with various Motorola or RCA radios, and to us ZWP was like any other machine. On the other hand, the rest of ZWP's inhabitants, who were using the "made for amateur radio use" type transceiver, suffered severe co-channel interference from both .19-.79 and .22-.82. This held true for both American made as well as Japanese import transceivers. The cause of this problem was the lack of i-f selectivity exhibited by this equipment and, in a number of cases, changing the ceramic i-f filter and its associated components proved to be a cure. Radios using the Murata filters were the easiest to change since Murata has an office in New York and was able to supply direct replacement filters with steep selectivity curves. Changing from the factory supplied "B" filter to a series

"F" filter solved the problem in my IC-2F Base Radio. Since much of the equipment now available was not on the market during the time that ZWP operated .205-805, I cannot give any evaluation on other newer equipment. Suffice it to say that if you intend to operate on a split-split system be prepared for the possibility of extensive modification of your radio if it is of 1972 or earlier vintage. Simply said, you will need a receiver with very narrow i-f bandwidth, comparable to a Motorola "A" Strip using a Narrow-Band Permakay filter. That's about plus or minus 5 kHz deviation acceptance, 10 kHz overall! A "tight" front-end won't hurt matters either.

In this respect a word of caution. In many radios, especially the imports, making the necessary modifications may not be easy if you are not thoroughly acquainted with the art of working on a tightly packed circuit board chocked full of easily damaged miniature components. If you have never tried it before, I seriously suggest getting someone who has the proper experience to do it – or let the manufacturer's representative perform the work. You may have no idea how easy it is to create an expensive repair bill for yourself in that way. This is one time you should let the experts do it and pay whatever it costs. It will probably be cheaper that way. Not only is the new narrow filter needed, but modification to the audio and squelch circuits for proper audio recovery and squelch circuit action is also necessary.

So far we have discussed the split-split repeater in relation to its users. How about its effect on the rest of the FM community? Initially, it was a disaster, especially to the two systems on either side of us. Our deviation peaks were playing havoc with .19-.79 and .22-.82, even after careful checking with a deviation meter. As the newcomer, and in order to live in harmony with the rest of the systems, we finally dropped the average deviation level to 4 kHz and went directional in our antenna system. In turn, this limited our coverage area and many people complained that the repeater's audio seemed low. Well, it was – part of the price we had to pay for being on a 15 kHz channel.

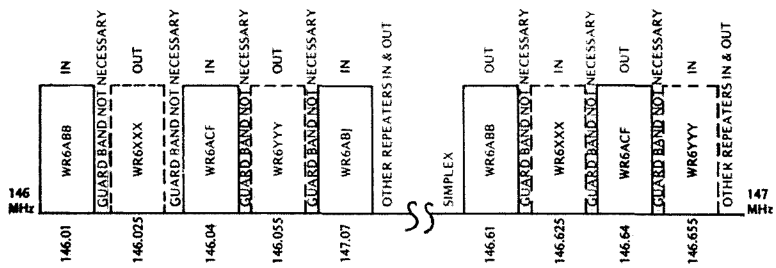

Fig. 2. The MWRA Inverted Split-Split plan using existing Southern California Repeaters. Note that the user's receiver sees a clear 30 kHz channel at all times unless close to a station on the input to an adjacent repeater. This plan has been adopted and implemented by SCRA for Southern California.

Had we owned something like an Altec Audio AGC Amplifier-Processor we could have remedied the situation. Ah, but they cost the kind of money not found in amateur circles. This broadcasting industry device permits you to have a constant audio output amplitude level, regardless of the input level. I now have one of these gems sitting in the closet and I can assure you that it will be part of any future system I put up, regardless of band or split.

When we planned ZWP, we hoped it would become an alternate SUR, and to that end had installed a Super-Stationmaster as the receiving antenna with the intention of eventually purchasing a Duplexer for the system. When the co-channel interference problem became evident and forced us to go to a directional transmit pattern, that dream sort of ended for me. I think we were lucky in that the two other systems were to the west of us, and, using a final combination of a 3 element vertical beam and a 3 dB gain vertical fed through a co-phasing harness, we were able to create a bearable though not perfect compromise. Keeping the transmitter power at about 20 Watts out also helped, but frustrated many users in peripheral areas of our coverage. The machine could hear a lot more than it could talk to, but it had to be that way in order to survive at all. It also created some rather weird deadspots in our prime coverage area. In fact, it was possible to drive east along Atlantic Avenue, still have the Williamsburgh Bank Building in sight (the former home of the machine) and not be able to hear it – a fact that a number of users will attest to, myself included. Yet with all its problems it still managed to cover Brooklyn, Queens and part of Long Island's South Shore fairly well. Not the super-repeater of our dreams, but something better than nothing. If we proved anything in the year that ZWP was on .205-.805 it was that a split-split system could exist in even as densely repeaterized an area as New York City if we were willing to make a lot of sacrifices. That's where things stood in September '72 when I left New York and moved here to Los Angeles.

As a point of interest, ZWP (now WR2ACV) has found a better way to survive – thanks to a rather dedicated number of supporters who wouldn't give up. In November '73 the machine came back on the air after almost nine months of silence. In the interim a number of changes had taken place, in the form of a totally solid-state system, a new site in lower Manhattan and a shift to a one megacycle separation pair of 147.43 in, 146.43 out. This was quite an improvement over the system I had said goodbye to (as I recently found out on a trip to NYC). In this you have the final chapter of the original WA2ZWP, as far as I know the first "big-city" split-split repeater.

What did we learn from all this? First, anything is possible if you are willing to pay the price. In our case, the cost was both limited coverage and adjacent channel problems for many of our users. The split-split system will work if you are willing to hold to the limitations it entails. First, don't try to put a wide coverage system on such an allocation. If you need wide coverage then either make use of one of the established systems or, if you simply must own your own repeater, put it on 220 MHz. Heaven

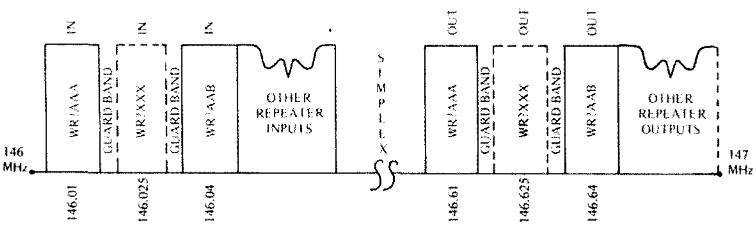

Fig. 1. The ARRL adopted Modified Texas Plan showing 15 kHz splits implemented and assuming 5 kHz deviation. Assuming nominal 20 kHz user receiver bandwidth, massive interference can result necessitating modification to user's radio.

knows we need as much activity up there as possible. However, if Two Meters is a must for you, then I can only suggest that all parameters be carefully considered before erection of such a system. Carefully analyze where all your prospective users will live and what areas they normally cover in their daily routine. Then choose a site that will afford the proper coverage while utilizing the minimum necessary power for good quality communication. In cities such as Los Angeles and San Francisco we have an advantage in terrain type which may prove to the benefit of this type of allocation: Mountains and valleys. Using .205 – .805 as an example, if I were to put such a system up to cover the San Fernando Valley where I live, I would put it on the tallest structure I could find at the base of the Valley – not on one of the surrounding mountains. It is doubtful that such a system sitting 100 feet above street level would bother .19 – .79 in Anaheim or .22 – .82 in Pomona, both about 50 miles away. Running nominal power, it could cover this area far better than simplex and yet the mountains would act as a natural shield, containing the transmitted signal to this area. On receive, they would have the same effect in relation to the two other systems, minimizing co-channel interference problems. Using a site atop one of the mountains would most likely play havoc with the other systems. Along the same line of thought, it will be necessary for repeater councils considering the sanction of such allocations to assign frequency pairs that are as geographically separated from established systems as possible. Also they must establish operating parameters before making such assignments, and enforce their decisions. In amateur radio, peer pressure is the best weapon.

From the foregoing, you might get the impression that using split-split channels in areas with heavy repeater density (areas where there are no more 30 kHz channels to be had) can lead to more problems than it can solve. Well, give hams what seems to be an insurmountable problem and someone always finds a solution. There had to be a way to utilize all those vacant 15 kHz channels and do so with a minimum of impact on those already on the air, both repeaters and users. This was the problem that faced Southern California and its repeater coordinating organization last January. The Southern California Repeater Association had a long list of applications for two meter channel assignments and no channels to give out. They had run out of available spectra two years earlier. A decision was made to issue the tertiary 15 kHz channels, but based on a suggestion made to the SCRA by Bob Thornburg WB6JPI, President of the Mt. Wilson Repeater Association (and after careful consideration by the SCRA Technical Committee), SCRA elected to issue the tertiaries on an inverted basis.

Under the MWRA* plan, the inputs of the tertiary allocations are put between the outputs of existing systems and the outputs of the tertiaries are between the inputs of existing systems. This means that the average user's receiver always sees a clear 30 kHz slot unless his next door neighbor happens to be transmitting on a repeater input 15 kHz away, and in that case it would take more than a narrow receiver to solve this problem. If some interference does occur between systems, then only the receiver of the repeater will require an up-grade in the selectivity department – or an adjustment to the repeater transmitter's deviation. In 99% of the cases, the user will be unaffected and will not have to go through the agony of tearing into his radio. Sounds nice you say, but can it really work?

Probably the busiest open repeater in the United States is the Mt. Wilson based WR6ABE system that boasts close to 600 users at present. Due to its location on Mt. Wilson's broadcasters' row, Burt Weiner K6OQK was forced to put ABE on a rather non-standard frequency pair in order for the system to function without interference to or from other electronic inhabitants of the mountain. ABE's input is 147.435 MHz, technically a split-split channel. (Its output is 146.40 MHz in case anyone is interested in using it on a visit to LA. All are welcome.) Not quite two years ago, another repeater, WR6AAB, came on the air utilizing 147.500 for an output. This put AAB's transmitter but 15 kHz from ABE's receive frequency. Initially, there was some minor interference to ABE, but Burt simply called Dave, the owner of AAB, and the two of them solved the problem in short order. This was because there was only one transmitter interfering with one receiver and the owner of each was competent in the fine points of two-way radio communication. It was two people working together which solved the problem, saving a couple hundred users from running out to get their radios modified as would have been the case had it been two repeater outputs interfering with one another.

*For a free copy of the MWRA Plan, send a SASE to: Mt. Wilson Repeater Association, P.O. Box 10193, Glendale CA 91209.

While this is by far the best plan to date for utilization of the 15 kHz split-splits, and one that Burt and Bob deserve a lot of credit for coming up with, it is by no means a carte blanche cureall. What I said before about the responsibility of repeater councils to be judicious in geographic spacing still holds true, as it does for site location and keeping a careful eye on those deviation peaks. In fact, it puts the same burden for proper system maintenance on all existing systems as well as the new systems. Why? Well, when all the tertiary splits are assigned and operational, all repeaters will be split-splits (technically) in relation to one another. This will force the system that has been thinking of narrowing its receiver bandwidth to do so, as well as to keep a sharp eye on its transmitter's deviation. All systems, new and old, will be forced to follow the same parameters, but the inverted split-split plan negates the problem to the user. It puts all responsibility on the repeater owners. With tight receivers, you will find that your users will be wandering off frequency a lot less often. Perhaps an automatic on-channel ID tone similar to the one used on WR6ABN and described by Art Gentry W6MEP in QST Magazine will be a great aid in corralling your users on your channel. If I had ZWP to do over again, I would have gone .805 in, .205 out. Who knows, had we thought of it then, it might still be there now.

The SCRA has already implemented the inverted split-split system that we might here dub the MWRA/SCRA Plan, and at the outset it appears to be a success. It will take time to know for sure and I will do my best to keep you all informed through Looking West. By the time you read this, WR6ACK will have moved to .805 – .205, to clear their present channel for a wide coverage Baja California repeater, and another system is already in the works for 147.705 – .105.

If all this seems unfair to you, I agree, but it is a necessity if the split-split type allocation is to survive. You might ask yourself the question, "Why should our group be forced to

live with restrictions that don't face others?" The answer is that you are late getting started in the game and you are being handed whatever is available. You are the newcomer and there are many ahead of you. Working within the known limitations is a heck of a lot better than not having a system at all. Don't try to cover the world with a split-split system, as it is easy to make enemies quickly that way. That's the last thing you need. Remember that you may be the first in your area to be assigned such an allocation, and everyone's eyes will be on you. Do things right and you may become famous for pioneering a new frontier in your city.

Are there alternatives to the split-split? The best one I know of is to foster interest in the development of 220 MHz systems. At this writing Southern California accounts for better than 50% of the 220 activity nationwide and has found it to be far superior to Two Meters. Also, if 450 MHz is not overpopulated, consider helping populate that band. (Forget it in California; we already need an additional 10 MHz up there to handle the existing activity!) 450 is even superior to 220 in what it will cover. And don't forget good old Six Meters. There is cheap equipment aplenty and that band in most areas is all but deserted. If we don't populate it soon, someone might get the idea that it would be a good place for another CB band.

Another alternative might be a total restructuring of the Two Meter FM Repeater sub-band as is being experimented with by WR2AAA and WR2ACV in New York City. Technically, a 1 MHz separation between input and output is far superior to the present 600 kHz, and you could put a repeater every 20 kHz without much chance of co-channel interference. You could get a few more repeaters in that way, especially if you shift all simplex below 146 MHz. On the other hand, the cost of implementing such an idea on a nationwide basis would be quite high in relation to the benefits derived. That is, if you could ever get the whole country to agree on the switch. How many years did it take us to agree on the present system? Oh yes, and what about all those synthesized radios designed around a 600 kHz offset? Well, many of them will require some modification anyhow, if split-splits proliferate.

Our final alternative is to petition the FCC to change the rules banning amateur repeaters below 146 MHz. That's not without its drawbacks, too. Just below 146 MHz is the part of Two Meters used for satellite communication and, unlike with a repeater, you cannot ride up to your favorite Amateur Communications Satellite to plug a new crystal into the receiver. Even if we could convince the FCC that we must expand downband we must also remember that FM is not the only mode in use on Two Meters and we must respect the rights and interests of others. If you only operate FM on Two, you are missing a good part of the fun that band has to offer. There is a lot of interesting stuff between 144 and 146.

There might be other alternatives yet, but at this late hour I cannot think what they are. I suspect that the heavily populated areas will go the split-split route en masse and that they will do so soon. If you wind up with one of these allocations, I can only suggest that you strictly adhere to any parameters of operation set forth by your local Repeater Council and play it by the rule-book. In retrospect, I kind of wish there had been a rule-book back in January '70 when at some ungodly hour INM said, "Let's put up our own repeater." It's a heck of a lot easier to follow one than to help write one the hard way!

... WA6ITF

73 Magazine Staff

Saving the 15m Quad- By converting it to 20m

With the sunspot scene still on the decline and various scientific guesses about its low point ranging from mid '76 to mid '77, many OMs who enjoyed DX on 15 meters wish they had a good antenna setup on 20 meters. Although there doesn't appear to be much difference between antenna lengths on 15 and 20 meters, amateurs who have built cubical quad antennas will readily testify to the noted difference in structual size, rotator requirements, etc., between a 15 and 20 meter quad. For this reason, many amateurs choose to build a 15 meter quad while band conditions on 15 were still good for DX. Good DX openings on 15 are now becoming short in duration and more and more rare, and this situation will continue for several years.

The sunspot situation is not new, of course, but it brought to light again the methods amateurs used years ago to get their 10 and 15 meter antennas to operate efficiently on the lower frequency bands. One very interesting method was developed by some European amateurs to do this with cubical quad antennas and that is the subject of this article. In contrast to the methods of inductive loading of cubical quads which have been presented in more recent years, no loading coils are involved and an absolute minimum of alteration to the cubical quad reflector and driven elements is necessary.

The basic idea behind the conversion scheme is shown in Fig. 1. Fig. 1(a) shows a single quad element as it normally appears. The total circumference is somewhat over a wave length at the operating frequency. One can think of the quad element, for a moment, as a folded dipole antenna where the two parallel wires have been pulled apart to form the diamond shape. As in the folded dipole antenna, the high impedance points appear at the end of the antenna or in the case of the quad, at the right and left corners as shown in the diagram. If the corners are tucked in, as shown in Fig. 1(b), the current flow is still in phase in each of the two parallel conductors. The resonant frequency of the antenna will therefore also remain approximately the same as when the two parallel conductors are replaced by a single conductor connected to the high impedance points on each side of the quad. The final form of the shortened quad is shown in Fig. 1(c). The idea is really not very new. Some amateurs may remember similar lengthening schemes being applied to folded dipoles when those antennas were the "latest" thing.

A practical application of the foregoing scheme is shown in Fig. 2 as applied to both the driven and reflector elements of a 15 meter quad that is to be converted for operation on 20 meters. An approximately 10 foot long piece of wire is run from each corner of the driven element and reflector along the plane of each element and then parallel to the boom. Where the wires run parallel to the boom, they are spaced about 15" or so apart. These wires have to be trimmed in the tune-up process so they should be initially connected together at the center of the boom as simply as possible by some insulating material. Plastic clothes line (the kind without a metal core) will suffice. Any of the usual tune-up methods for a quad can be used but a simple one involves only the use of a grid-dip meter. If a grid-dip

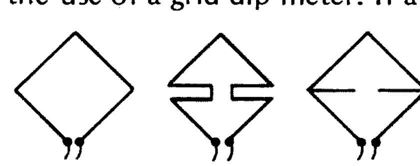

Fig. 1. Development of a folding technique for loading of a cubical quad element.

meter is used, check its frequency readings first on the station receiver. Some of the cheaper kit types easily can be off in calibration by a whole amateur band and that is not going to suffice for antenna tune-up purposes!

A grid-dip meter is connected directly in one of the antenna elements by winding a turn of the antenna wire around the coil of the grid-dip oscillator. The feeder line to the antenna is disconnected. First, the reflector element is tuned with the driven element terminals shorted. The two wires attached to the reflector are equally shortened until the grid-dip meter indicates resonance at a frequency about 5% *below* the desired operating frequency. The grid-dip meter is then used on the driven element and its loading wires trimmed to achieve resonance at the desired operating frequency. For those who are enjoying the outside weather while doing all this, a further refinement of the reflector tuning can be undertaken to achieve *either* maximum forward gain *or* maximum front to back ratio. They cannot both be simultaneously achieved. The 5% rule described above will suffice for practically all situations without further readjustment. The antenna may be fed as usual by coaxial cable either directly, or via a balun transformer. The bandwidth of the modified antenna will depend upon which segment of the 20 meter band the antenna was chosen to favor. If a typical quad is tuned up to the middle of the 20 meter band, the swr will rise to no more than 1.8 or 2.0 at the extreme band edges so the loading system has a minimal effect upon bandwidth. The typical 15 meter quad so modified can certainly be considered to have a usable bandwidth which encompasses the entire 20 meter band!

The results achieved with antennas modified in the above manner have all been reported to be very good. No exact measurement data is available, but it would appear that the forward gain of such a modified antenna is about 2-3 dB less than a full sized quad on 20 meters, which is a very reasonable figure. The only other difference noted between the modified quad and a full size one is somewhat increased side radiation from the modified quad. This is to be expected in view of the loading wires running parallel to the boom. The front to back ratio appears to be as good as that of a full-size quad. It should be noted that the converted 15 meter quad will automatically have an element spacing on 20 meters which is smaller in terms of wave length than that usually recommended for quad antennas. If the spacing was .125λ on 15 meters, it falls to .094λ on 20 meters. Although it would be unusual to have the possibility of extending the boom length on a modified 15 meter quad, if this could be done so that it measured .125λ on 20 meters even better results should be possible.

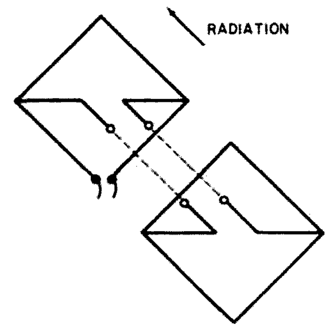

Fig. 2. Loading of the driven and reflector elements of a cubical antenna.

Two final questions may develop. How about a dual band quad by switching in and out the loading wires? And, can a 20 meter quad be converted in a similar manner for 40 meter operation? A dual band quad probably could be developed by some method of switching in and out the loading wires. Relay switching would be very difficult because the points of connection of the loading wires to the quad elements are both high impedance and thus high voltage points. Trap switching by means of 21 MHz traps at the connection points would seem to be the only possible solution. There is a greater jump in terms of wave lengths between 20 and 40 meters than there is between 15 and 20 meters. But, the loading scheme described should be just as applicable to the conversion of a 20 meter quad to 40 meters. Reduced bandwidth (relatively) and somewhat increased side radiation are to be expected in such a conversion but this may be an extremely small price to pay when one considers the enormous difference in dimensions between a 20 meter and 40 meter cubical quad.

. . .**Staff**

Eric Falkof K1NUN
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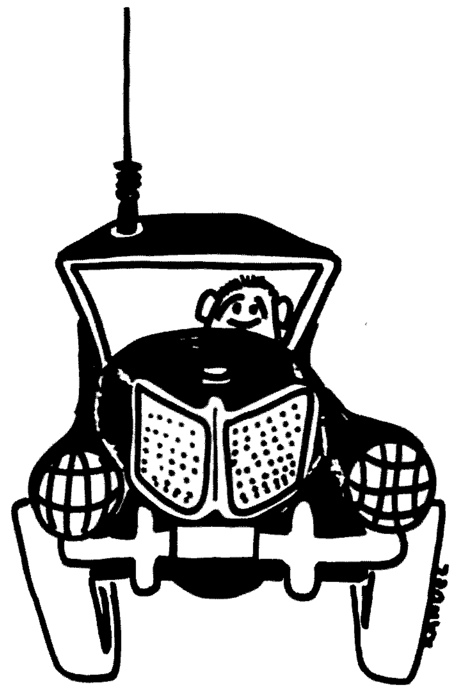
Waltham MA 02154

The Rime Of The Ancient FMer



1959

The tale of the ancient amateur
With rig covered o'er with grease
Who on his way to hamfest far
Said, "Lord, this din must cease."

The Ancient FMer traveled to a hamfest with his mobile AM rig installed in his car.

"The QRM and QRN
For ears as old as mine
Cause headaches, gas pains, other ills,
Cured naught by dramamine.

"There must be sigs that crystal clear
Can enter ears so old,
Of such a mode that rings so true
I have ne'er been told.

"Methinks this mode called FM
Like taxis, police and fire,
It sounds so clear and trouble free
It may be what I desire."

So the FMer reviewed the magazines
And found a rig so true,
He pruned the coils and dutifully toiled
'Til finally said, " 'twill do."

The Preprogs and FMTRUs were examined until a workable unit was found.

1969

With crystals set on ninety-four
And squelch opened wide,
The ancient FMer set on his way
To travel the great Divide.

Having won a Sweepstakes ticket, the ancient one is freed from worldly tasks and starts a long vacation.

"Hello CQ," he cheery called.
But not a sig in sight.
"This rig be damned! This mode so grand?"
He turned the squelch down tight.

A tail burst through limiter stage,
"Oho!" he gladly cried.
Again and again it noisily sang, and
"We don't call CQ," the voice cried.

The ancient FMer makes his first QSO.

"I'll not offend my new-found friend,
But please, benevolent sir,
What are the rules, the hints, the tools,
Lest your wrath I incur?"

Like a stone the speaker sat dumb.
The FMer raged and cursed.
The speaker sat like a gnat,
As silent as at first.

The FMer learns the first rule of FM operation.

On he drove across the road
Into a town so bleak.
A QSO was in progress. He called . . .
Alas, his sig was weak.

"Try again," a voice came through,
"I can hear your signal clear.
Three-four transmit! Quick select it
And use the repeater."

A new aspect of FM is introduced to the lone driver.

"Repeater, what is this? It cannot exist!
A thing heard but not seen?"
"Yes, my friend," the voice did send,
"It is the great machine.

"Upon the hill it sits so still
'Til signal it doth detect.
Then retransmit it far and wide,
Giant antennas? No need to erect.

"Your 3-4 rock will hit the spot
Where receiver oven is tuned,
The greater range of your good rig
So greatly will mushroom."

The trick of using the repeater is revealed.

The ancient one looked in his rig
To find the crystal data,
And to the company sent a request
For a crystal to use the repeater.

The rocks arrived and put inside
The rig so grossly complex,

Another channel he installed
For repeater and simplex.

The FMer realizes the increasing sophistication of the hobby.

"Break!" he called and gave his call
As all on freq gave way.
"Emergency station, give your location
Give your traffic to save the day!"

"I only wanted to say halloo
As I passed your city location."
"Ne'er repeat your woeful deed
As 'Break' is for emergency stations."

The FMer learns his second lesson.

"QRZed" called the friend
On two meters as westward he rode.
"We don't use Q-Codes. We say 10-8."
And silence as the squelch closed.

Individual differences in operating become apparent in different locales.

The QRM it grew intense
In southern California
9-4 was a cacophony
Of stations with a mania.

Under each station was another
And yet there were still more.
The constant jabber, useless palaver;
Two meters became a bore.

Growing tired of so much talk was wearisome to his nerves.

"I must escape to a quieter place
With antenna farm up so clear
That I can escape from valley and cape
Yet still use machines far and near."

Age begins to tell on the old man.

1973

A magazine came on the scene
To tell of developments new,
And 'stead of surplus, commercial, junk box,
The imports were selling here too.

A new source of gear was revealed to the recluse.

"Smaller still than commercial swill,
And current drain so low.
This is the way to operate;
Multi-channel too? What ho!"

His interest revivifies itself upon reviewing the gadgets available.

To the city. . .What a pity,
The channels are so thick,
With intermod and other crud,
Clean signals one cannot pick.

Rice box, rice box, everywhere,
Everyone, foe and friend;
Rice box, rice box, everywhere?
Where will this mess all end?

Capture, capture, cried the box,
As signals weak were squashed;
Turn your antenna, this time we'll get ya . . .
"It's time my hands were washed."

He sold his rig and danced a jig
To a youngster with brand new call.
"220? 450? 1296?
I have done them all."

And so my friend, this is the end
Of an ancient FMer. No lie!
His timer has passed, and now, alas,
He's a control station at that machine
in the sky.

The OM contacts his final Repeater.

. . . K1NUN

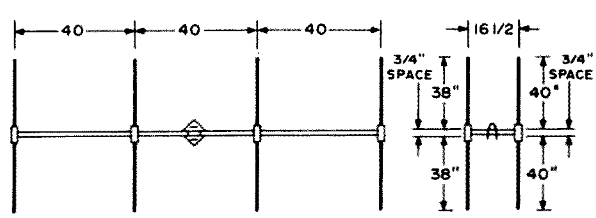
* * *

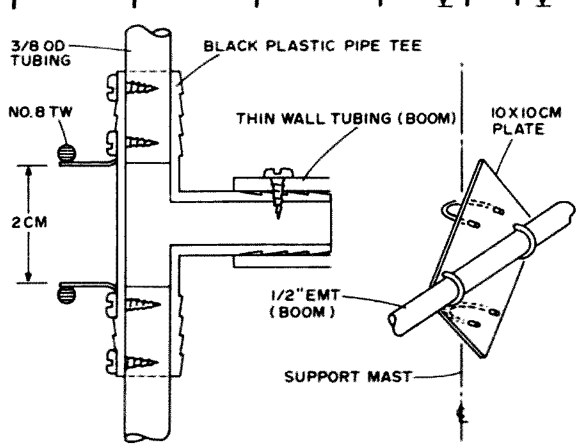
A Two Meter Collinear You Can Make

French Bishop K4NOC
2758 Burlington Avenue N
St. Petersburg FL 33713

Here's a relatively easy to build 16 element collinear for 2m that will cost $10 or less, depending on your junk box and scrounging ability. The boom and supports are 1/2" EMT (thin wall conduit); the elements are .9cm x 1mm (3/8" x .040") wall standard aluminum tubing. Refer to the drawings for construction details. Dimensions are to center lines of tubing. I used #8 TW solid copper wire for the phasing lines. I stripped off the insulation and spaced them 2cm (3/4") apart. The balun is made of RG-8/U and its length is a little shorter than most figures in radio handbooks. I suggest starting an inch longer and trimming it for a good match. It takes a little time to achieve this but it's worth it.

I have one indication of antenna gain for the record. Dave Springer helped me by using an in-line variable attenuator on his receiver. We compared the collinear to a ¼ wave ground plane with both at the same height and both fed with RG-8/U. Dave is about six miles away and had to use 12 dB of attenuation to drop the collinear signal down to equal that of the ground plane. Though the numbers may not be perfectly accurate, they do indicate a substantial increase in gain. If you would like more than a ground plane, give this beam a try. You can put it together in an afternoon.





Parts List

1 – 1/2" x 10' conduit; 4 – 1/2" x 15" conduit; 8 – 3/8" x 40" aluminum tubing; 8 – 3/8" x 38" aluminum tubing; 8 – 1/2" black plastic pipe tee; 1 – 4" x 4" x 1/4" aluminum plate; 6 – 3/4" or 1" U-bolts; 2 – 1 1/4" or 1 1/2" U-bolts; 50 – #6 x 1/2" sheet metal screws.

. . .K4NOC

Michael W. Babb WB4UAN
506 Westwood Drive
Louisville KY 40243

Do You Know This Man?

"The handle here is Mike, old man, and I'm operating mobile on the outer expressway. So how copy? K4ABA, this is WB4UAN mobile four. Go ahead, OM.

"Okay, Mike . . . real fine . . . Yeeeaaahh. Lessee here . . . WB4ANE, I believe, and the group . . . this is W4ABA on the 34/94 repeater. You gotta real fine signal there, Mick . . . stronger than that last fellow that was on the machine. You must be closer to me than he was. A little noisy, though, at times. My handle is Bill. Brother . . . I . . . Love. . .Lucy. Yeah! Bill, as in short for William. So how you doin' this afternoon? WA4UNE in the mobile . . . this is K4ABA at the base.

"K4ABA this is WB4UAN mobile four. The call is Whiskey . . . Baker . . . Four . . . Uncle . . . American . . . Nancy . . . U . . . A . . . N . . . There Bill, and the handle is Mike, not Mick. I spell . . . Mary . . . Item . . . King . . . Easy . . . Mike. Okay on my signal. Thanks very much for the good report, but I believe the strong signal you are receiving is the repeater's, not mine, since the repeater is hearing my signal and retransmitting it. You're getting a good signal from the repeater, there, Bill. Go ahead.

"Right you are . . . WA4AUN this is K4 . . . Always . . . Be . . . Alert . . . Yeah, Mike, I know all about them machines, there, and I know a strong signal when I hear one, and you got one, ole buddy. I ain't never heard such a signal on two meters before. Ole Jack was a talkin' on here before you got on, and he wasn't a pinnin' my meter like that signal of yours. I guess it's sorta like addin' signals together. Yours and the repeater's to get a real strong signal. What? Oh. Yeah I did . . . I think I did. XYL here is remindin' me to give ya my handle there, Mick . . . guess it slipped my mind. It's Bill . . . Brother . . . I . . . Love . . . Lucy . . . Bill.

"And as you may know, that's short for William. Like in King William The Fourth or whatever they called that feller over in G-land. Haaa! You remember him from high school don't you, Mick, ole buddy? Back over to ya. Whiskey Four . . . Ahhhh . . . Nancy . . . American . . . Able, this is--oh yeah . . . in the mobile--this is kilowatt four always . . . be . . . alert . . or at least cautious . . . haaa! Go ahead there, Mick.

"K4ABA, this is WB4UAN mobile 4. Okay Bill . . . You still don't have the call right. If you've got a pencil handy, why don't you write it down this time. It's W-B-4-U-A-N, and I'm mobile four. Put it in the logbook, Bill, and write it on a QSL card, while you're at it. I'll be sending you mine. That's part of the hobby I like most. Well, Bill, I'm just about at the destination. It's been real nice talking with you. I'll turn it back over to you for your final transmission. K4ABA, this is WB4UAN mobile 4.

"Lessee here . . . Whiskey number four Uncle Alpha Michigan . . . That's a right nice call, there, Mick . . . This is kilowatt four ain't been asking . . . at least not lately . . . Haaa! Hee . . . Hee . . . Hey Mike, what kind radio you talkin' on anyway? You really gotta fine signal up here on the hill. 'Bout the strongest on two meters. Mine here is a Mallard 10-4, with a homebrew skyhook fed with open twinlead. Go ahead there, Mike, and tell me what kinda box you're usin' there. Break Break.

"It's a homebrew rig running about

twenty watts into a commercial whip with 3 dB gain mounted on the rear deck, Bill. I've really gotta sign with you this time, old man. I'm at my destination, and I'm late for an appointment. 73 and nice talking with you. K4ABA, this is WB4UAN. Good afternoon.

"Yeah, Marshall. Say, if you're gettin' them kinda results from a homespun rig, you must be pretty good at all that technical stuff. Personally, I had a hard time gettin' my technician ticket . . . and I still don't know beans about one of these here Mallard radios, which I'm a usin' to talk to you on. Say . . . I got an idea, Mac, how's about us gettin together sometime and you givin' me a few pointers on this electricity stuff, anyway. I'd be happy to supply some eats and brown 809's or whatever you fellers call it these days. How 'bout some Saturday morning? We could bring the XYL and Harmonics along and have a real good time. Maybe even make a field trip to a park out of it. You could bring along the theory books and maybe some test questions and answers, if you know what I mean, there, Mel. The XYL here . . . Lucy . . . says that would be mighty fine with her. Saaay . . . How's about this Saturday, Mick? WA4UAN mobile, but portable at the old destination, probably in the driveway, here is kilowatt four anything but asparagus. I don't like asparagus too well, there, Mick. Go ahead with your next transmission. Break Break.

. . . .

"Hey Mick, you on there, ole buddy? Go ahead there, Mick. WB4AUN, takin' a short standby, here's K4ABA.

. . . .

"Well, that homebrew rig of his must not have been so hot after all . . . it didn't even last through the QSO. QRZed . . QRZed QRZed two meters . . . the 34/94 repeater . . . here's kilowatt four anybody before August . . . at the base . . . how copy? Break break."

. . . WB4UAN

Charles Landahl W5SOT
121 Barranca Road
Los Alamos NM 87544

A New Q5er - The R-11A

The civilian version of the BC-453 is on the surplus market. Although it is designed for remote control and has no dial, it can be placed in operation rather easily. A spin tuning knob or some other method of tuning the receiver through its 190–550 kHz range is needed. Fair Radio Sales and Meshna offer such knobs. Connect filament and plate power as shown in Fig. 1.

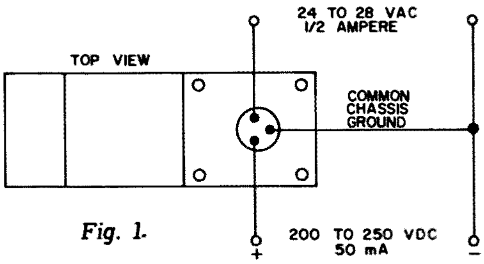


Fig. 1.

At the front panel, J-603, find the pin which has green wires coming to it from the cathodes of the 14A7 rf and i-f tubes. Connect resistors to this pin as shown in Fig. 2.

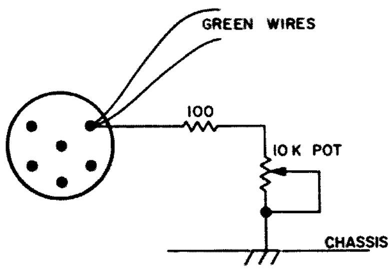
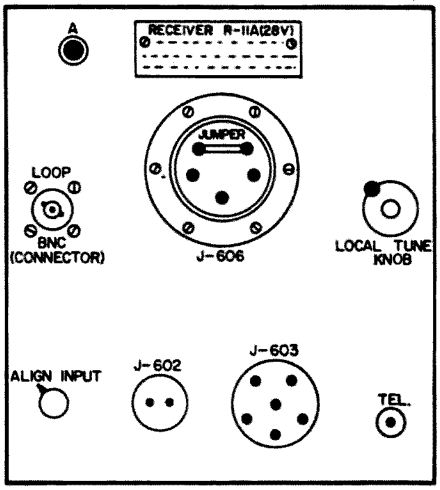


Fig. 2.

The R-11A is ready to operate. With antenna connected it will receive AM and MCW signals from weather station broadcasts in the low band. Its sensitivity is about 5 microvolts at the antenna post. When used as a Q5er in conjunction with the 455 kHz i-f signals from your station receiver, you can copy CW and SSB by turning on the main station receiver BFO. I added an 85 kHz external BFO by building a transistorized one which uses junk box coil. Others may have this same coil in their parts collection. Voltage for the FET can be taken from the cathode of the 12A6 audio tube. Plus 12 volts is available there.



The front panel can be cleaned up and put to use. Both J-602 and J-603 power and control plugs can be removed and discarded. The loop antenna switching relay may also be removed. Just clip the wires from these parts and let them hang or shove them aside. Don't let the wires short out or touch the chassis. With those parts out of the way, the front compartment can be used for the gain control potentiometer, an on-off switch, or whatever you wish. I swapped the antenna and loop input wires so that I could use the BNC connector to bring in shielded wire from the i-f of my station receiver.

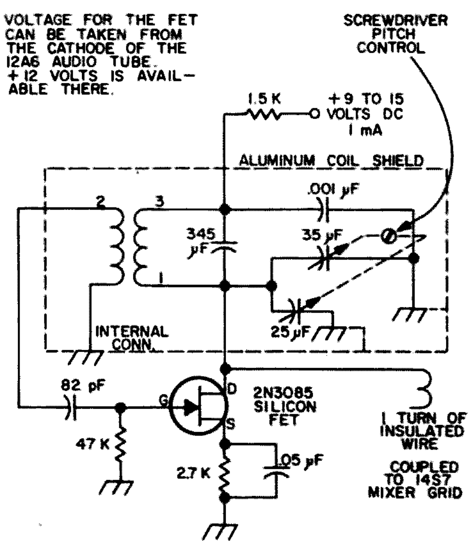


Fig. 3. All parts inside shield can are original values. The field effect transistor is from Poly-Paks.

Calibration is roughly 12 kHz per revolution of the spin tune knob. Therefore plus and minus 3 kHz is easily estimated when tuning SSB. . . . W5SOT

B. T. Ring K3VNR
6619 Powhatan St.
Riverdale MD 20840

Now — A 5/16 Wave Antenna?

Judging by the number of 5/8 wavelength antennas now being used for 2m operations, this is undoubtedly the most popular of all 2m antennas. This popularity seems to be well deserved, since the 5/8 wave antenna has about 3 dB gain over a 1/4 wave antenna and it is not excessively long. It would appear then that this is an ideal antenna for 2m mobile work and there should be little hesitation when it comes to selecting an antenna.

Faced with the task of mounting a 2m antenna on a subcompact station wagon, several problems had to be resolved. An antenna was needed that would be compatible with the size of the car and still approach the effectiveness of the 5/8 wave antenna. Although a 5/8 wave whip for 2m is not very long, when mounted on the roof of a subcompact it is almost as awkward looking as a 10m whip on the roof of a full sized car. The 1/4 wave antenna would be more suitable in size, but then it would not have the gain attributed to the 5/8 wave antenna. The cost factor also had to be considered since commercially made 5/8 wave antennas are rather costly. The higher cost for such an antenna is understandable because more is involved than just the antenna length. Contributing to the cost is the special base containing an impedance matching transformer which is needed to match a 50 Ohm line to the high impedance of the antenna.

A temporary compromise was reached by using a 69cm stainless steel broadcast type replacement antenna. This type of antenna is made to fit over the broken stub of the standard car antenna. Since this antenna is only slightly longer than 5/16 wave for 2m the higher impedance presented a reasonable match to the 50 Ohm coax. The inductive reactance introduced by the extra length of the antenna was tuned out with a series trimmer capacitor at the base of the antenna. With this antenna there was a noticeable improvement over a 1/4 wave mounted in the same position. Moreover, the size of the antenna was still in keeping with the size of the car.

This 69cm antenna was then used as the basis for a much improved antenna. By building out the electrical length of the antenna to 5/8 wavelength with a base loading coil and using a matching transformer to match the high impedance to a 50 Ohm line, it was possible to achieve an efficient antenna without greatly increasing the physical length.

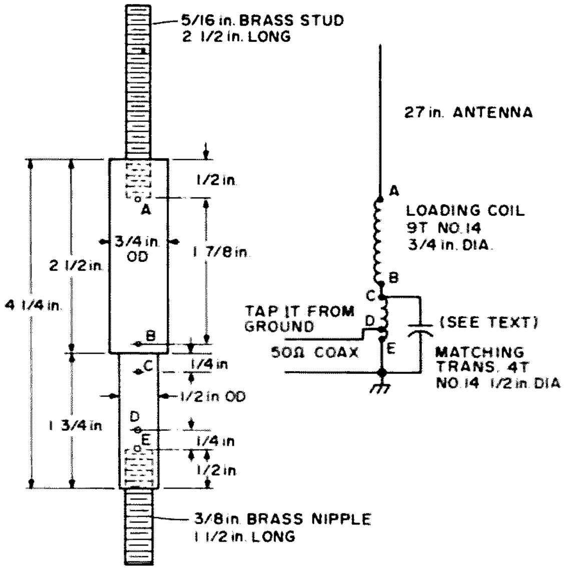


Fig. 1. Composite loading coil-matching transformer fabricated from telescopic tubing.

The unique feature about this antenna is that instead of a separate loading coil and matching transformer, these coils were wound as a composite coil on the same coil form. The complete coil assembly is protected from the weather by a housing made from PVC pipe enclosed at both ends by pipe caps. The stainless steel whip is attached to a 5/16 inch threaded brass stud at the top end of the housing, and a 5/8 inch threaded brass nipple is used at the lower end of the coil for mounting on the car. The 50 Ohm feedline passes through the nipple to the transformer, which is tuned for maximum output.

Two versions of the loading coil-matching transformer combination were made. Both performed equally well with the 69cm whip. The first version is almost 5.08cm shorter, but where the additional height is not objectionable the second version is easier to construct.

The first coil form was fabricated from telescopic polystyrene tubing having the following dimensions:

LENGTH (cm)	OUTSIDE DIAMETER (cm)	INSIDE DIAMETER (cm)
6.35	1.9	1.58
6.35	1.58	1.27
10.79	1.27	.95
2.54	.95	.63

The tubing is telescoped together, and holes large enough to pass #14 are drilled as shown in Fig. 1. All holes except D are drilled through both sides of the tubing. Hole D is for the coil tap (which is the feed point) and is drilled through one side only. Ream out the end of the smallest tubing a little to take the .80cm stud which will be heat fitted into the tubing.

The coils are wound from a 101.6cm length of #14 tinned wire. This is more than enough wire, but the extra length will facilitate handling. Bend the wire into a 1.27 cm wide hairpin with one side about 74.93 cm long and the other about 25.4 cm. Insert the long end through hole B and the short end through hole C on the side of the coil form which is opposite to hole D (both ends should protrude from the same side as hole D). Dress the loop of the wire down close to the coil form. Grip the end of the long wire in a vise and apply tension while winding 9 turns spaced over the length of the form to hole A. Pass the excess wire through hole A, but do not cut.

Place a .80cm X 6.34cm threaded brass stud into the opening at the top end of the form. This stud can be cut from threaded brass stock, or it can be a brass machine screw with the head removed. Hold the coil form in a vertical position so that the stud is facing down. Press the stud against the top of the work bench and apply heat to the stud with a soldering iron; at the same time apply pressure to the coil form to force the stud into the polystyrene tubing. Stop when the stud reaches the wire in hole A. Bend the end of the wire and loop it around the base of the stud. Cut off the excess wire and hold the loop in place with a brass nut over the stud. This completes the loading coil section.

The matching transformer consists of 4 turns on the 1.27cm section of the form

wound in the opposite direction from the loading coil. The feed point tap is one turn up from the ground end of the coil, so be sure not to cover hole D with the wire. After the coil wire end is passed through hole E use a short piece of flexible insulated wire to make the tap connection. Bare about 1.27cm of the wire and pass it inside the tubing and out through hole D and solder it to the coil. (Instead of the tap wire, the center conductor of the feedline could be soldered directly to the coil.)

Make a 1.27cm wide copper ring from 1.27cm copper pipe and slip it over the tap wire on to the coil form. This ring serves two purposes: it reinforces the polystyrene tubing and later it will also be used as part of the tuning capacitor. Insert a 1.58 X 3.81cm brass nipple (the type used in electrical fixtures) into the end of the tubing over the tap wire. Apply heat and pressure as with the stud at the other end until the nipple is seated against the coil wire in hole E. Bend the end of the coil wire over the copper ring and loop it around the nipple. Cut off the excess wire, and hold the loop in place with a lock nut over the brass nipple.

A combination fixed capacitor and adjustable gimmick wire are used to tune the matching transformer. The fixed capacitor is a small ceramic type with a value of about 3 to 5 pF. One capacitor lead is soldered to the copper ring along with the coil end wire. Solder the other capacitor lead and one end of a 15.24cm length of teflon covered hookup wire to the top end of the matching transformer (junction of the two coils). Use insulating sleeving on the capacitor leads to prevent shorting to the coil. Wrap the loose end of the gimmick wire around the copper ring but do not solder. Hold the gimmick wire in place with polystyrene coil dope. Tuning of the transformer will be done later.

The second version of the loading coil -matching transformer differs from the first one mainly in physical dimensions. Because of this, the number of turns on the loading coil is also different. The coils are wound on a single piece of 1.27cm diameter polystyrene tubing 15.24cm in length and having an inside diameter of 1.59cm. A 5.08cm piece of 3/8 OD 1/4 ID tubing is inserted at

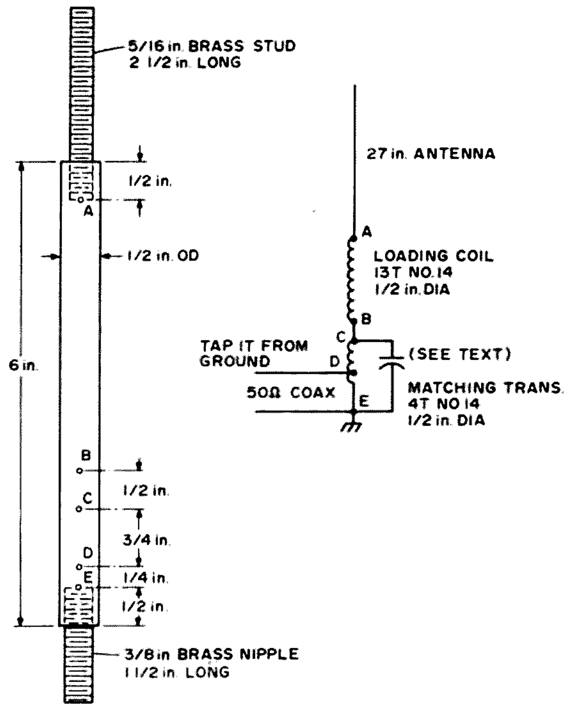


Fig. 2. Composite loading coil-matching transformer using single diameter tubing.

the top end to take the brass stud. Holes for the 14 gauge tinned wire are drilled in the coil form as shown in Fig. 2. Again, hole D is drilled on one side of the form only.

Before winding the coils three copper rings are prepared from 1.27cm copper pipe. Two rings are made 1.27cm wide; the other is 1cm wide. The 1cm ring is positioned on the coil form between holes B and C. The other rings will later be placed on both ends of the coil form.

Bend a 101.6cm length of wire as in the first composite coil. Insert the long side in hole B and the short side in hole C on the side of the form opposite to hole D. The wire should straddle the copper ring and come out on the same side as hole D. Wind 13 turns for the loading coil. Place a copper ring on the end of the tubing to prevent splitting when the .80cm brass stud is inserted with heat.

The matching transformer coil and tap are made the same as in the first version. The copper ring and brass nipple are also installed the same as before. The fixed capacitor and the gimmick wire are both soldered to the copper ring between the loading coil

and the matching transformer. The other capacitor lead goes to the end ring and the gimmick wire is wrapped around the end ring.

To protect the coils against the weather, they are enclosed in sections of PVC pipe. Cut the pipe about 1.27cm shorter than the coil forms to allow the end caps to be drawn up tight against the coil assembly. The first coil uses 2cm pipe, and the second coil uses 1.27cm pipe. Check to be sure that the inside of the pipe clears the coil assembly. The end caps are standard PVC pipe caps drilled to fit over the .80cm stud and 1.59cm nipple. The caps are held in place with additional brass nuts. After final tuning, the joints can be sealed with PVC cement, epoxy or RTV.

Tuning of the antenna coil assembly should be done with the complete antenna mounted on the vehicle. If the whip antenna has a coil spring base, shunt the spring with a flexible wire, or shielding braid, to assure a good connection when the spring flexes. With the PVC sleeve and the lower cap off temporarily mount the complete antenna assembly on the car and connect it to a transmitter through 50 Ohm coax. Prune the gimmick wire a small amount at a time while watching for maximum output as indicated on a field strength meter. When the signal strength just begins to drop push the end of the gimmick wire back against the copper ring and hold it in place with coil dope. The tuning is now completed and the coil assembly can be sealed in the PVC housing.

Comparison tests made against a 1/4 wave whip mounted in the same position on the car indicated that the two base loaded antennas had some gain over the 1/4 wave antenna. No measured comparison tests were made with full size 5/8 wave antennas, but signal reports received were encouraging, and indicated that the base loaded antennas were able to hold their own along with the long ones. In actual use, there was little if any difference in performance between the two base loaded antennas. The first model described perhaps had a slight edge; possibly due to the higher Q of the larger diameter coil.

. . . K3VNR

73 Magazine Staff

ICOM

THE NEW VHF GIANT

More and more hams in recent years have found Japanese gear to their liking; "Expo 70" undoubtedly contributed to this trend. Among the millions of visitors to Osaka and the Expo site were amateurs from all parts of the world. The Expo had an amateur station on the air throughout the fair (JA3XPO) and that further quickened ham interest. Finding wide varieties of portable, mobile, and base station transceivers blooming in the shops of Tokyo and Osaka, hams had a field day. Enormous amounts of gear not available up to that time on the European and American market were lovingly packed and carried home. VHF boomed, and wider interest in solid state along with it. Not far from the Exposition site is located one of the country's major VHF-UHF producers, ICOM – Inoue Communication Equipment Corporation.

This organization, begun in 1963 by Tokuzo Inoue, produces the only VHF transceivers capable of operating in the heavy rf fields found at the base of Tokyo Tower; actual tests were held, and ICOM emerged victorious. The success story of Toku, as his friends call him, beginning at age 25 in electrocardiograph design, graduating to Sharp as a design engineer, and finally founding his own company, would

Tokuzo Inoue, owner and founder of ICOM.

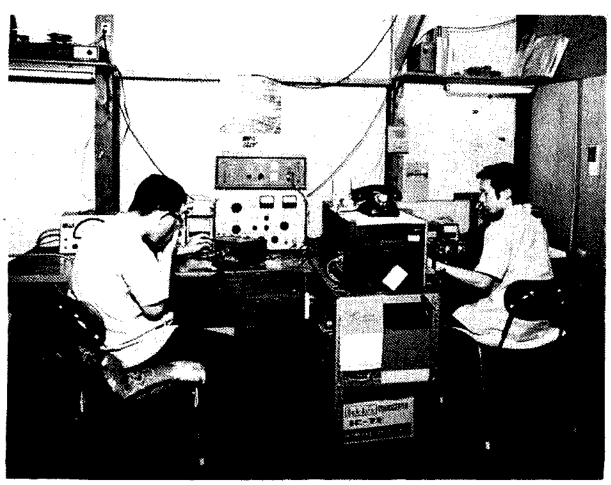
Main offices and assembly, located in Southeast Osaka.

Part of the second floor Testing and Assembly Section. The rf shielded booths are visible at the left.

fill a book. This 42 year old engineer's versatility and imagination are reflected in the quality products his firm produces.

The original ten employees who began with the company, with not much more than a dream, are still members of the "family". A family it is, and the feeling is nurtured by twice-yearly trips to scenic areas, ranging all over Japan. All at company expense. Bowling clubs, outside activities of all varieties, and quality control meetings all add to this family feeling. The company's motto "ICOM where quality counts" is more than just a catch-phase, it is a way of life. Company pride and spirit can only be described as fierce.

The Research and Development Section is the envy of their competitors, and Toku's pride and joy. This is where he can be found night and day. Truly amazing things are done here, with an offhand, casual appearance, and an intense feeling of accomplishment. To enter this beehive of activity is bewildering. Test equipment fills the floor space, draftsmen produce drawings of equipment that seems fantastic – yet a short time later, there it sits on the bench, operational.



On-the-air testing: every set produced is tested on the air, the results retained for five years.

Larry L. Essary WA5WWH
1568 Bar Harbor
Dallas TX 75232

Review of the IC-30A

The growth of amateur FM repeaters on 450, as a new field of endeavor and communications, has been boosted to a great extent by the availability of rigs once used in commercial services. Commercial equipment of many types has been in the foreground almost from the start of this growth. Many repeater sites are inhabited by machines built around units that once saw duty in commercial services.

Numerous mobile hams can trace their rigs to a similar lineage, but now 450 has come of age. If you have been in the market for a 450 transceiver, you are by now aware that there are few units on the market, but a new unit has been announced: the ICOM IC-30A!

The ICOM IC-30A could very well be the unit that will take the field! The transceiver is all solid state. It comes with five sets of crystals, and has 22 channel capability. It has a socket on the side where the mic, audio, push-to-talk and touchtone can be wired. It features a 10 Watt/1 Watt position power choice. With all these features it makes one wonder, "Where has 450 been all my life?"

The transceiver is modularly constructed. The receiver oscillator uses 24 MHz. There are Overtone crystals to provide output in the 433-435 MHz range. The signal is mixed with the incoming signal to provide an i-f output in the 10.69 MHz range. The 10.69 MHz is used deliberately to enable the IC-30A to be used in conjunction with two meter and other 10.7 MHz i-f rigs. The transmitter uses crystals in the 18 MHz range of the usual "AT" cut. The transceiver uses a T-R relay instead of diode switching. Reverse polarity protection is employed in the unit by means of a diode. If accidental reversal happens, the supply will see a short circuit, thus protecting the unit by blowing the fuse.

The IC-30A comes with crystals for 449.0, .1, and .2 high-in/low-out repeater or simplex on 446.0 or 446.5. The unit has individual trimmers for transmit and receive oscillators.

Typical of most low cost radios is the intermod caused by local ham repeaters and front-end overload by commercial frequencies. After finally getting up enough courage to drive through downtown Dallas during peak communication hours (not to mention the downtown drivers), I decided to see if the IC-30A would perform typically and be paralyzed by the rf field. Much to my surprise I carried on a QSO on a direct frequency, without a gurble of intermod or overload. The unit even has a transmit light and a COR light. Only two notes of dislike, but minor ones: The 9 pin socket only comes wired for discriminator (and you have a 5 minute job to search through the maze of wires to hook it up) and the IC-30A comes equipped with a metric thread, S0239, so it must be changed out.

In conclusion, I found the ICOM IC-30A to be a very pleasant and easy to operate unit. There are not too many knobs and switches to confuse you, and with 22 channel capability you will not be limited to 6 or a dozen channels. 450 is not like two meters was just a few years ago, when you had to scan the band looking for a QSO. 450 has come of age with the growth of UHF activity, and you will find it a new frontier to conquer. I'm sure you will enjoy every minute of it just as I have!

. . . WA5WWH

Dee Logan W1HEO
175 Fairmount Terr.
Fairfield CT 06432

New Life for the SX-111

Replacing the rf amplifier with a "hotter" tube, substituting a solid-state rectifier for the 5Y3 and complete realignment gives the SX-111 a new lease on life.

Toss the 5Y3 and substitute a silicon plug-in module from Poly-Paks. Or, if you have silicon rectifiers with peak reverse voltages of at least 1400V (GE-511), one can be installed between pins 4 and 8 and the other between pins 6 and 8 of the 5Y3 socket. Remove the 5V filament windings from pins 2 and 8. A 51Ω 2 watt surge resistor should be inserted in each leg of the HV secondary ahead of the diodes. Transient protection can be supplied by a GE-X14 thyrector or metal oxide varistor across the primary.

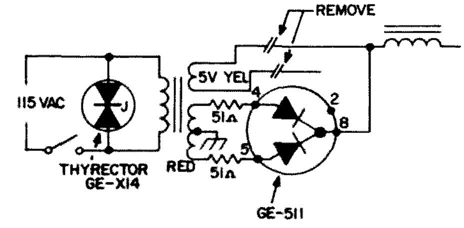
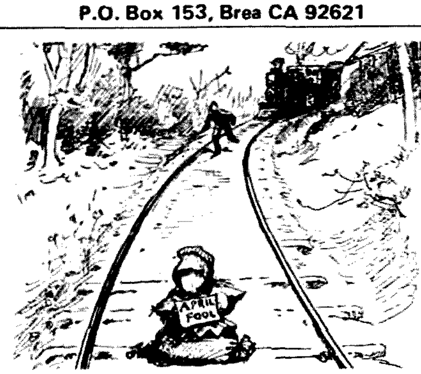


Fig. 1

Substituting a "hotter" 6EW6 rf amplifier for the 6DC6 improves transconductance from 5500 to 14,000μΩ. Bases are similar, so the tube can be simply plugged in. Change the cathode bias resistor from 180Ω to 56Ω at pin 2.

The plate and grid voltages are still well within the 300V maximums allowed for the 6EW6, so no further changes were made. Performance was comparable to the receiver portion of a TR4 in terms of sensitivity.

...W1HEO



W2NSD from page 3

other than the most relaxed rules they can make.

Of course there is no way I can counter every possible argument in a brief editorial, but it would be fun to get a large group at a convention and work over as many aspects of the situation as possible.

Docket 20282 seems to offer virtually nothing to anyone – except possibly a few Extra Class phone frequencies to the Advanced Class ops – and it takes away privileges wholesale. Two-thirds of the amateurs would be cut in power and just about everyone would have to go back to the books again to take more FCC exams – and ante up to the U.S. Treasury for each test.

I have a feeling that Walker has his heart set on making incentive licensing work even if it kills us . . .

For my part, as publisher of 73, docket 20282 looks great. I'll be able to sell books and code cassettes for all those myriad of license grades – imagine eight different classes of license! Our Novice study guides are selling very well – as are the Novice study cassettes which have the theory plus Q&A on four one hour cassettes. The General Class Study Guide is doing fine – the Advanced Class Guide is selling well – and so is the Extra Class. Watch for my Communicator Class license guide and Experimenter Class license guides. I'll have to get busy on theory cassettes for Communicator, Experimenter, etc. . .

I have a feeling that Walker has his heart set on making incentive licensing work even if it kills us, so I don't hold out much hope for 20282 to get shot down, even if a lot of amateurs agree with me that it is a waste of time. Perhaps next year when he retires we'll do better and be able to get our rules to reflect the simple goal set out in 97.1c: To advance skills in both the communications and technical phases of the art.

OSCAR FEVER

One of the local Oscar fans was enthusing at a meeting of the Interstate Repeater Society (Geeze, how I hate the name of that club . . . dunno just why, just something about it that grates on me.) – anyway, this chap was saying that all you had to do was tune down to 145.95 when Oscar was passing over and you'd hear all sorts of interesting things being repeated from 432 MHz.

One afternoon a few days later I got to looking at the orbital chart in 73 and, after a fast calculation of GMT, decided this was the time to try it out. The only tunable receiver was my trusty Comcraft CTR-144 – the little rig I use to find secret repeaters and to fruitlessly tune the lower parts of the 144 MHz band listening for action. I put it on 145.95 with a counter and made myself present at schedule time. Nothing. Hmmm. I kept tuning up and down about 25 kHz and, outside of a small birdie generated by the Comcraft, nothing doing.

I had about given up, some four minutes later, when I began to hear all sorts of things coming through. I had the spotting switch on and was using the vfo as a bfo . . . first it was a W5 on CW . . . then a WA7 . . . then I began to hear several sideband stations. Tuning that vfo to demodulate sideband is not an exercise for the unsteady of hand. They were coming in from all over – W8, WØ, VE, even W2! I got so excited I ran through the

> **It would be gratifying to say that everyone came rushing in to hear the great wonders of satellite radio, but the cold hard fact is that I stirred up as much interest as an insurance salesman.**

73 offices calling out the news . . . hey, come on and listen.

It would be gratifying to say that everyone came rushing in to hear the great wonders of satellite radio, but the cold hard fact is that I stirred up about as much interest as an insurance salesman. Oh well.

Once the satellite pass was over and the band had died again I got to ruminating about the incident. I knew that I would soon be getting on 432 on sideband . . . I didn't know how, but I knew I would. And I would be getting a good sideband/CW receiver system set up for 146 MHz too.

It was in 1948 that a similar thing happened to me. I'd been reading about six meters opening up and decided to give a listen. I dug out an old pre-war Meissner FM tuner . . . it tuned from 40-50 MHz . . . I'll bet not many of you remember when the broadcast FM band was down there . . . when we used to listen to Major Armstrong's station at Alpine, New Jersey. Well, I dusted that off and tuned up to the high end just about 50 MHz and hooked on a short indoor antenna . . . WOW! Fantastic. W6, W7, VE7, and all points in-between. And they were boiling through S-9 plus. The wideband FM tuner mixed them all together . . . I used it later to keep an ear on the band for openings.

Within a couple days I had a converter hooked on my SX-28A and a small transmitter, both of which I had thrown together in a flurry of midnight building. I worked everything and had a great time.

Oddly enough this early six meter work had a direct influence on my getting into ham publishing. It was along about 1950 that Perry Ferrell got involved with the Radio Amateur Scientific Observations (RASO) project to investigate six meter propagation and I was one of the amateurs who set up a beacon on 50.1 MHz. Perry eventually became editor of CO Magazine and, knowing of my interest in RTTY, signed me on as RTTY editor.

Six meters was a lot different in 1950-1952. I was living in Brooklyn and I was the *only* active amateur on the band in Brooklyn! There were a couple chaps over in New Jersey, a few up north of the city, and now and then Ed Tilton would come on from up in Connecticut. Everyone was crystal controlled so I could tell instantly who was on the air just by measuring their frequency.

So here we are with another exciting development: Oscar 7. I'll have to get caught up on the state of the art in satellite communications — with data to know when the satellite will be available — a good uplink converter for my low band rig — a good antenna for it — a hot receiver for the downlink on 146 MHz — a cassette recorder to keep a record of the contacts. Watch out for me.

There are several ways of tuning in the 145.95 MHz Oscar 7 output — even with simple gear. One way would be with an FM receiver and a communications receiver tuned to the 10.7 MHz i-f output — that would enable you to copy the sideband and CW signals. A little converter is pretty easy to put together for the band, and you really don't have to go for DX sensitivity — or perhaps one of the excellent Vanguard converters.

Once you start listening you may find yourself hooked.

. . . Wayne

Sam Kelly W6JTT
12811 Owen Street
Garden Grove CA 92645

Try 160 CW With This Transmitter

Realizing the shortcomings of my surplus TCS transmitter on the 160 meter band, I decided that either major surgery was in order, or a new transmitter. Choosing the latter solution I quickly checked my budget and found it depleted as usual. Therefore, any new construction had to rely heavily on easily obtainable surplus components.

Basically the transmitter consists of a vfo that tunes from 3.25MHz to 3.45MHz, the output of which is heterodyned with a 5.25MHz crystal oscillator to produce a 1.8MHz to 2.0MHz output. Both oscillators are continuous running. Keying is accomplished by blocking the grid of the mixer and the final amplifier.

The vfo used was a surplus Collins 70-K1 which was found in a local surplus store for less than 10 dollars. Since these may not be readily available elsewhere, the circuit of an alternate vfo (which was tested) is included.

The final amplifier is a pair of 1625's operating in parallel into a pi section network. 1626's were chosen because of their abundance at about two bits each, plus the fact they are quite rugged.

The power supply uses a surplus receiver power transformer with a high voltage secondary of 340-0-340V. This is bridge rectified

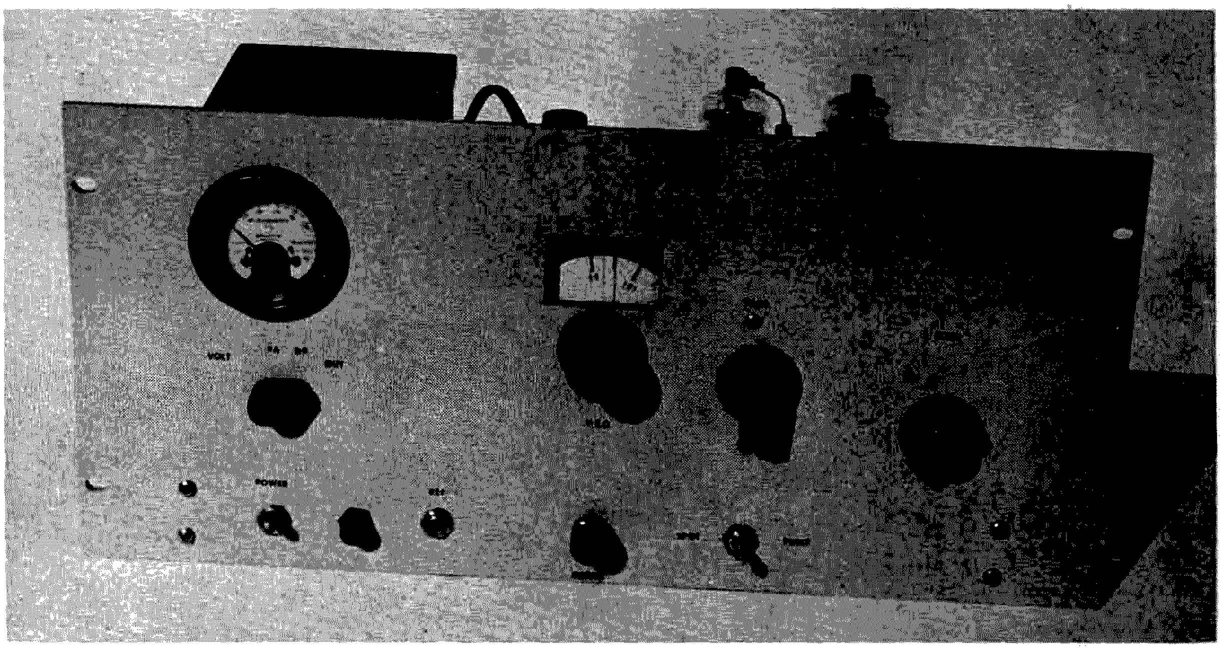


Fig. 1. Front view of the 160 meter heterodyne CW transmitter.

to produce about 940 Vdc at no load. A choke input filter from the center tap provides +300V for the other stages. A small 6.3V filament transformer is connected backwards across the 6.3V winding of the power transformer to provide bias for the mixer and final amplifier.

While the bias voltage could be keyed directly, I am partial to low voltage keying so I used surplus reed relays for keying, receiver muting and side tone keying. Antenna switching is done by a simple TR switch.

The top view of the transmitter is shown in Fig. 2. The vfo mixer sub assembly was built on a 4 x 6 x 2 inch chassis. The vfo shown is the surplus Collins 70K-1. It is highly desirable due to the extremely good linearity. It provides only 150kHz coverage, but this is adequate for most geographical locations. The alternate vfo circuit is shown in Fig. 4. A surplus link variable inductor from a Navy ATD transmitter tuning unit (3 – 9MHz) was modified by removing two turns from the rotable link. The remaining 2½ turns were then mechanically adjusted for maximum linearity. The final tuning range was 500kHz.

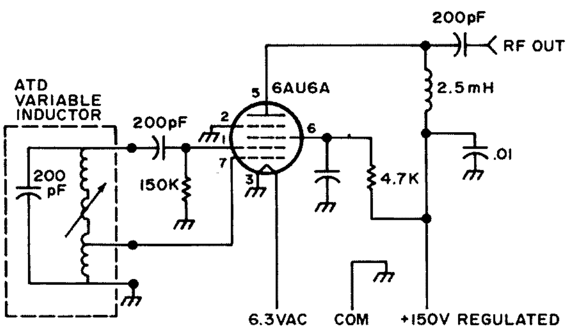


Fig. 4.

Transmitter construction was done in three stages. First the power supply stage (Fig. 5) followed by the vfo-mixer (Fig. 6) and then the driver – final amplifier (Fig. 7). Most components were mounted on simple tag strips. The sidetone oscillator, keying relays and meter multipliers are mounted on small pieces of fiberglass Vectorboard which are rigidly supported on standoff bushings.

Using the component values shown, the meter reads 1000V full scale (fs) in position 1, 500mA fs in position 2, 15mA fs in position 3 and relative amplitude in position

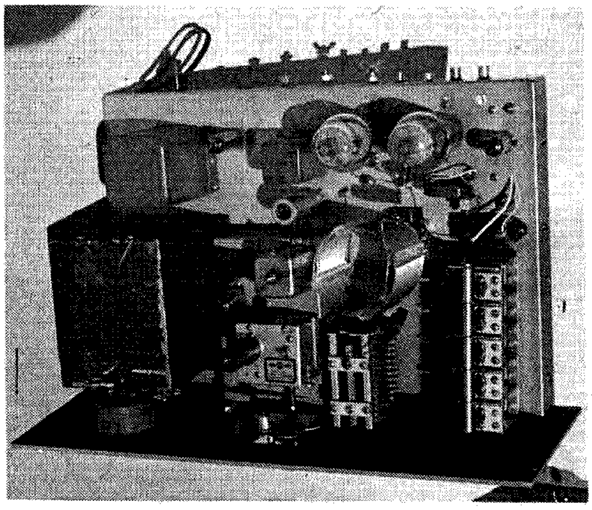


Fig. 2. Top view of transmitter with shielding removed.

4. The 10mΩ resistor was made up of three 3.3M 2W resistors.

A word of caution on selecting a meter switch! Avoid the low cost phenolic imports as they won't handle the voltage. I had one fail destroying the meter. I replaced it with a Centralab ceramic switch which has held up very well.

Filter capacitors are mounted on a heavy bracket under the chassis. A separate shield assembly is provided for the TR switch. A bottom plate and screen cage around the final tank assembly complete the shielding.

Alignment and check-out is simple. The vfo-mixer assembly is best aligned and calibrated using an oscilloscope and counter. However, satisfactory work can be done with a grid dip oscillator and either a LM or BC-221 frequency meter and a receiver. Adjust the slug in the mixer plate coil for a

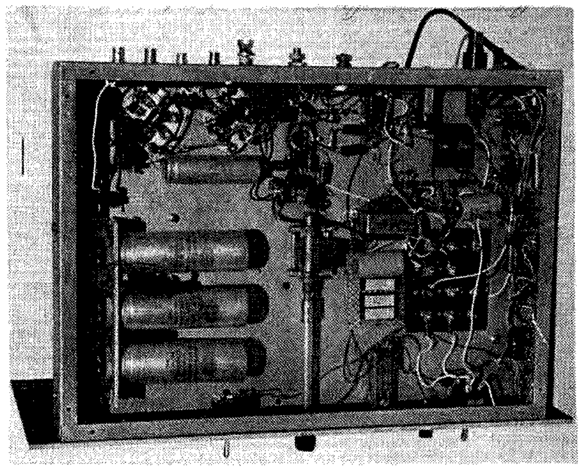


Fig. 3. Bottom view of the transmitter.

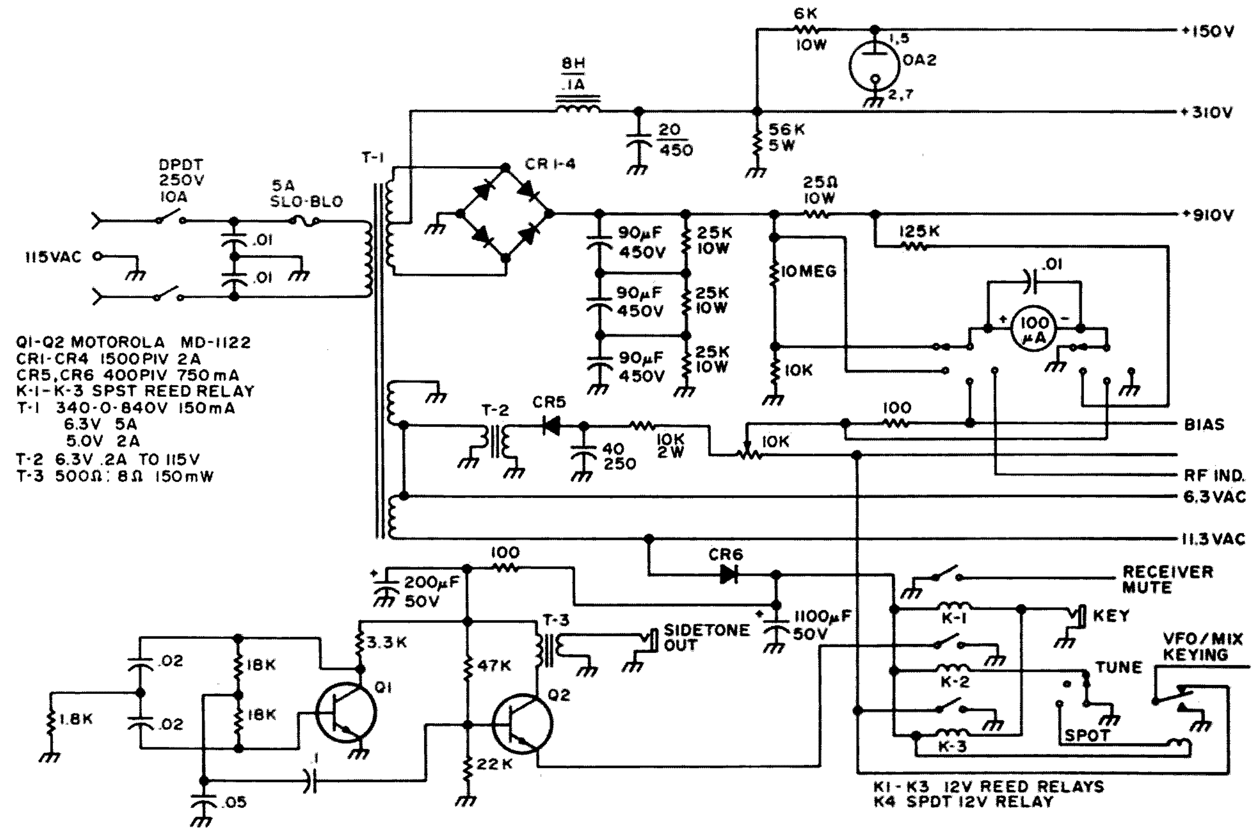


Fig. 5.

maximum output at 1.9MHz, checking to insure that the output is really in the 160 meter band! The vfo dial can now be calibrated.

Next, the driver and final amplifier are aligned. Set the drive level control at minimum. Place the spot – tune switch in the tune position and adjust the drive level control (checking to see that the driver tuning control is adjusted for maximum grid drive) for plate current of 200mA with the power amplifier resonated into a 50 Ohm dummy load. Incidentally, power input can be reduced using the drive control to meet FCC regulations for the various geographical areas.

A note on the vfo dial construction is in order. While any vernier drive assembly can be used, it is difficult to beat the one shown for being cheap! The illuminated dial mechanism was made using a National Velvet Vernier planatary drive drom a scrap BC-375 tuning unit.

The dial itself was made from a piece of aluminum sheet cut out with a fly cutter. After spraying white, calibrations were applied using rub-on transfers. After the calibration was checked, the dial plate was given several coats of Krylon. The cursor was made by scribing a line on a small piece of lucite which was cemented into a panel cutout with model airplane cement.

A black baffle was placed behind the dial plate. A 5/8 inch (standard) hole in the baffle accepts a standard push-in lamp

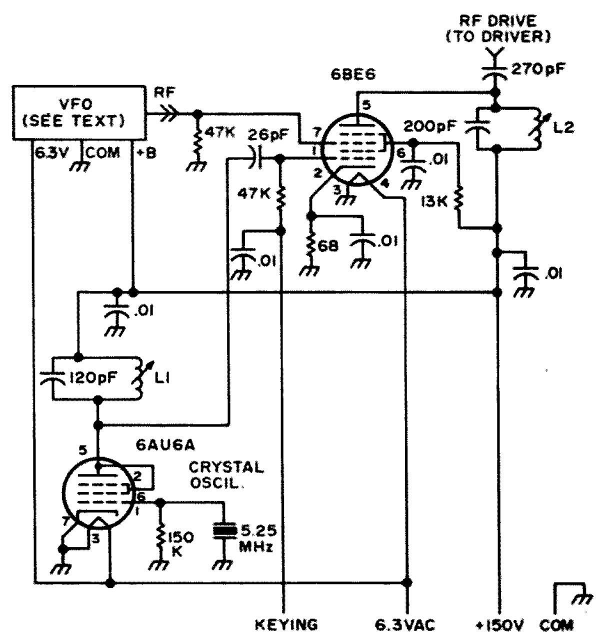


Fig. 6.

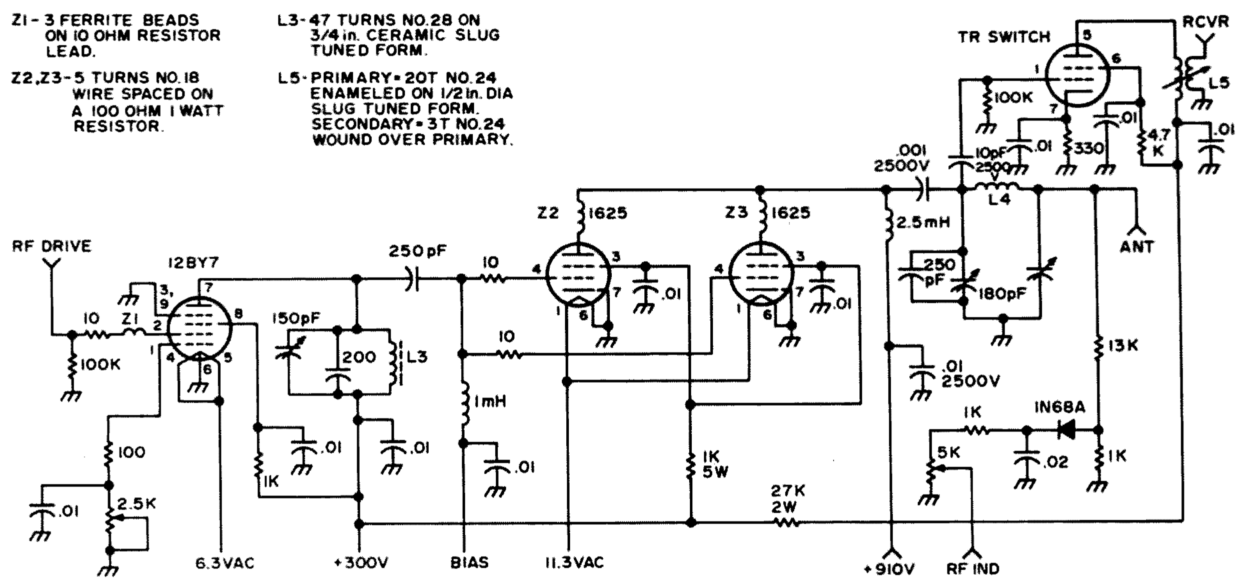


Fig. 7.

socket. The assembly was completed with a small skirted drive knob. The combination of the main dial calibration with skirt dial markings allows 1 kHz readout.

Unless you are fortunate enough to have an antenna system that presents a 50 to 75 Ohm load at these frequencies, an antenna tuner will have to be used. At this QTH a simple rotary inductor from a BC-375 transmitter works well. Tuning is accomplished by tuning up the transmitter into the 50 Ohm dummy load then switching to the antenna. The variable inductor is then adjusted for maximum output power.

...W6JTT

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J.H. Nelson

Good (open) Fair (☐) Poor (O)

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U. S. S. R.	7	7	7	7	7	7	7A	14	14	14	14B	7
WEST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

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HAWAII	21	21	14	14	7A	7A	7	7	14	14	14	14A
INDIA	14	14	7A	7B	7B	7B	7B	7B	7	7	7	7
JAPAN	14	14	14	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7B	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	14B	7	7	7	7B	7B	7B	7B	14B	14	14	14
U. S. S. R.	7	7	7	7	7	7	7	7	7A	7	7	7
EAST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 amateur radio

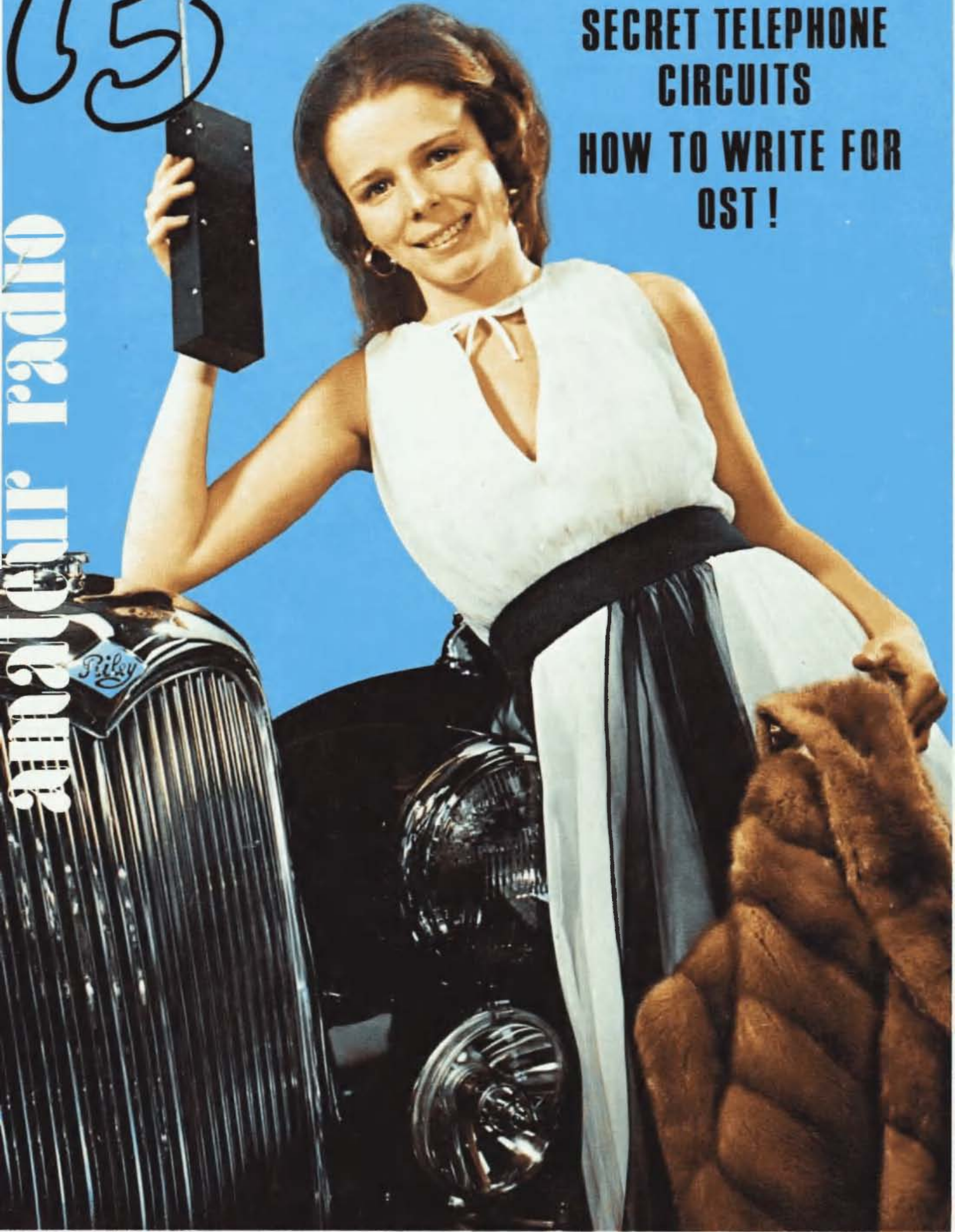
MAY 1975

ONE DOLLAR

FM BUYER'S GUIDE

SECRET TELEPHONE CIRCUITS

HOW TO WRITE FOR QST!



73 amateur radio

#176 MAY 1975

COVER: Classic 1953 Riley 4 door, available from Peter Marsh, 111 Leroy Street, Binghamton NY 13905. Dress, available from Drazens City of Fashion, Binghamton. Model Karen Kelly is not available.

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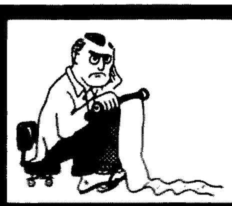


NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

OSCARING

A couple of fellows got after me at the local ham club meeting to at least listen in to Oscar 7 on two meters — they said I would have no trouble hearing it. The only thing I had handy for this was a Comcraft, so I looked up the satellite schedule in the Amsat column and started figuring out about when I would be able to hear it.

Since my interest arose on an "A" day, I had to wait until a "B" day when Oscar would be outputting on two meters — it puts out on 10m on A days, and I didn't have anything up for 10 at all.

Using the Comcraft — which is an AM/FM rig — in the AM position and with the vfo spotting switch on to provide a substitute bfo, I tuned around 145.95 at Oscar time . . . and there it was! Signals were pouring through. I had no great trouble copying the CW (except some were awfully fast), but SSB called for a very steady hand — I obviously needed something a little bit better than this — like a hot converter for the low band rig. What I was able to copy got me all fired up — OK, G, F, D, SM, OH, ON, PA, UR and things like that were coming through S7 or so.

Vanguard labs agreed to whip up a 144-146/28-30 MHz Model 407A converter. That should do it. I called Cushcraft to see about antennas — they are about the only outfit making circularly polarized antennas. I figured I would get even better results with their twist array on 2m, though my simple vertical was doing remarkably well, even at the end of 100 feet of the VHF resistor we call coax.

Ed Jay of International Telecommunications had the misfortune to call about something — and we made Ma Bell rich talking about Oscar. It ended up with Ed agreeing to send along a Multi-2000 two meter transceiver and with Audioland (one of our advertisers) getting their nose out of joint since the unit sent to me had been earmarked for one of their customers. I'm used to things taking forever, so the arrival of the 2000 via UPS a couple of days later was an event. I just about demolished the box trying to get it hooked up and operating immediately — it had arrived just about five minutes before the last Oscar pass (for four days) on a B day. With about one minute to go I had it working and Oscar was pouring through fantastically — really loud. I tuned around and discovered that the SSB signals were not readable — they were on the opposite sideband! I looked for the switch to change — there was none. With but a few seconds to work on the problem I wasn't sure that I was in trouble, but I was pretty sure.

Ed Jay confirmed my worst fears — the 2000 is upper sideband only. Not that it is a big deal — they have a simple conversion to make it upper or lower sideband — all it takes is a second crystal, a switch and a couple of diodes for the switching circuit. I hate to wait on things like this. When I want to do something I like to get right at it and see results quickly.

On the next B day I was there with the 2000 and a tape recorder, getting all of the CW copy I could. After a few days I found myself filling a shelf with cassettes of Oscar signals. I'll have to take the time to edit these onto one single tape to play at club meetings. If that doesn't make converts, nothing will.

The Vanguard converter eventually arrived — RCA phono plugs, ugh — well, better than BNC. I made up the cables and hooked it up to the Signal One and waited for Oscar — beautiful. Even the SSB was clear now, though I think either system gets down to the antenna noise, so there is little advantage in sensitivity over the 2000.

The next step, obviously, was to get a signal on 432 — preferably on sideband. I started looking around to see what was available — and asking a lot of questions. The basic answer is that there isn't much available. VHF Communications has a small kit available for a mixer to take low level signals from 29 MHz to 432. I sent for one of those. I also sent for the 432 amplifier which would build up the output of the mixer to about 10 Watts.

I checked with Mike at KLM to see how he was doing with his Oscar gear – nothing for 432 as yet, but he has a couple of amplifiers in the works, one with 40 Watts out and one with 70 or 80 Watts. His Echo II SSB 2m transceiver is also upper sideband only from Japan, like the Multi-2000 – they are using USB only over there. He has a simple conversion kit for the EII to get it to switchable sideband. For A day operation on the 2m/10m translator the USB is just fine – it's only when you want to receive Oscar 7 on B days that you need the other sideband.

TPL used to have some 432 linears. I called Tom Litty and talked a good hour with him about the situation – and I may have gotten him interested in giving a listen – that will do it. If we can get Tom bugged to get on Oscar we'll all have some gear available. Tom thought he had a 28 volt amplifier around which might do the job for me, but he got just a bit evasive when I pushed him to change it to Class AB1 for sideband. We'll see. I asked him about using one of the 450 FM rigs, at least for CW – he didn't think much of that – stable enough for FM, but no good for CW was his observation.

Tom thought I might do best to take a couple of T-44 Motorola transmitters and convert them. One could be made into a low level signal source to feed into a mixer at 460 MHz. Subtract from that 28 MHz of sideband from the low band rig in a balanced mixer and then feed the 432 output into the second T-44 and amplify it. Sounds like a lot of work. Tom said he had a balanced mixer around that should do the job, an MD-108 – he'd try to find it and get it to me. I think that getting on 432 sideband is still a way off for me.

Well, there's always CW. I got out an SBE 146/450 transverter that I'd picked up a few months ago from a dealer who hadn't been able to sell it to anyone else. I put the 12 Watts output of the Multi-2000 into it on 144.050 and measured about one Watt dribbling out. The next step is to swing that up onto the tower next to the Cushcraft twist antenna and see if a couple of Watts of CW will break into the club.

Some company is going to start making gear which will produce 432 sideband and I think they will do well. The passband through Oscar is almost empty most of the time – a VE4 working a G4 – K2UYH and his potent signal talking with anyone who shows up – VE2BYG – most of the CW work is done at around 15/20 wpm, so a little practice with the 20 wpm cassette is in order.

HOTLINE EXPANDS

The two month delays on getting hot news out through a monthly magazine is most frustrating to everyone involved. Out of this frustration was born the idea for Hotline – a bi-weekly newsletter with the latest news of amateur radio.

Hotline started out with just four pages and covered DX news, last minute propagation reports, FCC releases, hamfests, auctions, conventions, news items of interest, jobs available in the industry, new products, etc. Now we've added regular West Coast reports, FM news, repeater updates, Novice news, solid state news, Amsat news and Oscar predictions and latest info, six meter hot news, SSTV news and circuits, Hamburglar reports, Ham Help needed and things like that. It's up to twelve pages now – each about double the size of a 73 page – which is like a 48 page magazine each month.

One result of this is that a lot of amateurs are able to keep up with what is really happening – and Hotline pulls no punches, you can bet – which makes for interesting things to talk about on the air and at club meetings – it also makes for better informed replies to the FCC dockets. It's fun to be one of the first to know.

Another result is that club newsletters are beginning to get some good interesting items to reprint, thus making the local newsletters more fun to read. Some Hotline items have appeared in over 300 club newsletters so far, and almost 80% of the newsletters are now including at least one Hotline item.

For $8 per year you can get it from the source – with a first class mail subscription to Hotline. It is usually

Continued on page 142

OOPS!

Our thanks to Ralph Taggart WB8DQT, for noting two corrections to two of his recent articles in *73:*

1) "Western Satellite Picture on Your SSTV Monitors", September, 1974, page 81, Fig. 1. In IC4, a jumper should run from pin 9 to pin 2.
2) "What Time is the Next Satellite?", February, 1975, page 48, Fig. 2. The reset line should also go to pins 2 and 3 of IC7.

HOTLINE HEADLINES

Another tower problem – WB2CKB in Linden NJ – over $2400 in costs for the suit so far.

WR2ABK Staten Island repeater provides emergency phone service for 7th and 9th precinct Manhattan police after phone fire.

FCC shelves Class E CB proposal – CB use of 220 docket cooling at least 'til the end of the year – waiting action on amateur restructuring docket, further studies of alternate CB bands.

Letter from retired FCC amateur head strongly suggests fix in the EIA/OTP Class E deal.

Moonbouncers at it again – WA6LET at Stanford Research Institute makes lots of 144 and 432 contacts.

DXCC fees inflate – substantially. $10 for members, $15 for non-members as of June 1. 5BDXCC to $20 and S25!

First Mobile in motion Oscar QSO by G3ZCZ/W8 in West Va. Next it'll be mobile to mobile?

Radio Shack scuttles 2m xcvr – decides market just isn't big enough.

Clegg goes to direct sales with new FMDX synthesized rig to keep price down within reason.

ARRL book prices increase – 33 to 50%!

TV repeater petition entered – for 420 MHz ATV repeater channel.

ARRL 450 MHz repeater plan opposed by Mid-Atlantic Repeater Council.

Bubble DX coming? High power xmtr has been creating bubbles of artificial ionosphere and providing 1000 mile VHF DX contacts.

Radio dealers concerned over move to direct marketing by Genave and Clegg – will Genave go back to dealers?

Buyer beware! Fifteen year old General Class Handbook still being sold by major publisher – hopelessly out of date.

Dying Korean boy saved by ham radio – story makes National Enquirer.

BE MY GUEST

Visiting views from around the globe.

WHO SAID CW IS DEAD?

I've been puttin off writing U this letter now 4 weeks, & U jus may not be there (in the snow) at yr 73 QTH, as I recalled readin somewhere that U & a group wer goin on another DX Europianpedion, that I 4 one wd most certainly wd sure hav liked 2 go on such a trip, but it wd take 2 many words, valuable paper 2 tell U all jus small talk . . . but now, as I type along here, I'm goin 2 wait till I hav an eyeball with the new March 73 issue . . . so jus hang on. OK, Here it is March 2nd, & we've been eyeballin our March 73 issue & we jus haven't sent in our letter on docket 2-282, but wer composing one.

I've jus finished reading over Richard Bash Reform or Die letter, & Let me say that I'm sure very glad that I waited 2 eyeball the March 73. Boy, I 4 one want 2 get his address jus so that we can let hin know that I know plenty of HROs that certainly don't aggree with his views (Oh I realize that you'd naturally be 100% in favor of his views. & I feel that in all fairness that U sure should hav printed his address, as well as his name. & yes, I'm certainly goin 2 do just as Rich said, 2 write 2 those in Sam Rayburn building in Washington 2 tell both them & the FCC 2 leave the code speed exactly where it is, 13 wpm, etc . . . 4 the General & Advanced-Class license. & if they jus can't Hack it. . 2 get a Tech license, & if they just can't get up 2 5 wpm . . . Well then, go & get a Children's Bander ticket, & get on the air . . Mine U Wayne, I'm so very happy that U printed Rich's letter, jus so that I can type more letters out 2 Washington . . & one of em is goin 2 Coldwater as Barry has been spouting off abt that B . . . Nixon who by the way, put in a Guy 2 take his place, that jus as bad as he & Johnson put together & is well on his way along with Kissinger, 2 sending this country on the Rocks . . That B, Warren did a pretty good job of it by putting out "laws" that Stink . . & if this Country had some law on the books like the wonderful Country of SINGAPORE then this so called America would be a thousand times a much better Country 2 live in, & let me say, that I'm Not alone in my thinking, as I've brought up, jus really how wonderful it is in SINGAPORE & just why it is . . as I've talked 2 airline pilots, Ships Captain's & crew members who hav been there in the last 3 or 4 yrs . . & everyone one of em said, yes Kenny, it sure would make a much better State like California a much better place 2 live & work in, if they didn't hav all of these "Beardo's & their friends, Blacks in our State (California) Oh I forgot 2 mention, that all Blacks & Beard'Os with their long hair are "Taboo" & are Not permitted in this wonderful Country of SINGAPORE as this is the "Law" when I was there visiting Doc Charan 9V1NR & many others when I flu over from Thailand where I operated with the HR call of HS1AGO. I know that you've been in SINGAPORE, but I just don't know when?

Dr. Young, VE3DDS's article, Mystery of Antenna Radiation is a very good article, but & Einstein's famous equation is very familiar now that some Russian agents tol em abt our secret's . . $E=MC^2$ C=S of L was jus of em . .

Monday, 3rd March . . 0142z . . been readin over the Australian exam's page, plus your Editorial on pg 2 . . Let me say that I think it's jus abt the finest one that U hav ever written, plus HotlineHeadline . . I sent in one of the SF Radio club NEWS, but I jus didn't receive any HotlineNEWS, so I'll send U another one . . The Be My Guest is another very good column that 73 outshines ALL the HRadio magazines, bar none.

Sorry if I jus may hav steped on a few toes, but that's the way we see it fr our window . . even my own Kids wer tol, that if they didn't cut their hair & shave that crap off, they jus weren't welcome . . so they took off a week later & we never heard fr em in 3 yrs, then one showed up, looking like the new Marine ad's in papers & magazine . . & said Dad, I thought at the time, that U should hav yr brains examined . . but it was your way of "thinking" but up untill 2 weeks ago, he said, I felt U wer way out . . then, something hit me out of the "Blue" & I jus can't describe it . . but I know that your 100% correct, & now I'm very glad that U tol us 2 take off . .

. . . Kenneth Mahoney
San Francisco CA

Simple Headache Remedy

During the holidays, with many football games on the one eyed monster, my additional operating time on six meters due to the much enjoyed NCSMA contest activity brought S-9 signal reports from several neighbors. They must have been putting up with it – since I moved to my present QTH last spring – but just didn't complain. They were trying to be nice to the weirdo with all the antennas, I assume.

After computing my effective radiated power with amplifier on and checking it with the TV Overload Chart on page 330 of the 1972 VHF Manual, I figured I have TVI trouble! Any TV within 450 feet of my 1500 Watt ERP SIGNAL would be within average 50 MHz overload range. Just to assure myself of a clean signal from my equipment I tried a 50 MHz tunable cavity filter on the output of my amplifier and found no change in TVI.

Research on the matter brought several interesting possible cures to my problem. One, which I really liked, suggested moving the transmitting antenna further from the TV antennas. The part I liked mentioned that the additional height of the antenna would accomplish this, as well as a lateral movement. Since one neighbor is only 200 feet from my

antenna I would only need to add 210 feet to my present 40 foot tower! The only way to finance such a feat would be to sell all my radio equipment or the house. Since they carry about the same importance I decided to try a less costly approach.

After talking with my neighbors they agreed to let me try several things on their sets. I found the on-off switch to cure all TVI problems while in the off position but I knew better than to suggest that. One set I checked had four conductor rotor cable for the antenna lead in but the owner had a good pic so he could care less how the signal gets to his set. I thought this would have to be changed but found out later it didn't.

I enlisted the help of a local ham to make test transmissions with my six meter equipment at full power and antenna beamed right at the neighbor's antenna. The coordination was carried out via 2 meter FM. With test transmissions I tried two commercial high pass filters. I won't mention brand names as they made no change at all. However, I did not try the Drake TV-300-HP, which I understand is the best commercial filter available. The third device I tried really amazed me: A simple quarter wave length open end stub of 300 Ohm twin lead. This is mentioned in the ARRL VHF Manual but I'll give more credit to a 73 publication entitled "TVI" by W6MOG, which goes into more detail on the stub. A picture on channel 3 which was completely blocked during modulation was perfect with the stub attached to the TV VHF terminals along with the antenna. The formula for this stub is:

$$\frac{246 \times (\text{Velocity Fact})}{\text{Freq of 6M signal MC.}}$$

The average velocity factor of 300 Ohm twin lead is 0.83. I cut the stub a little long to allow for pruning. Starting with 50" I trimmed about one inch off to obtain zero interference on the tube.

One installation had two sets on the same antenna. One stub cleared both sets of any trace of TVI. This is by no means a new method of dealing with TVI, but one which is so simple and cheap that it may often be overlooked. If you have an overload problem, or the next time you encounter such TVI, give the quarter wave stub a try first. You have nothing to lose.

. . . Dex McIntyre WA4ZIA

Reprinted from Newsletter, North Carolina Six Meter Assn.

Bill Pasternak on 20282

If - and only If

Up till now I have shied away from much public comment on this subject because I wanted time to think out all aspects. I have talked to many others on this subject, sat in on meetings where it was the main topic of the evening, and most of all, listened to others talk about it on the air. One thing seems evident: Not too many people have read 20282 thoroughly and many of the ones who did really don't understand it fully. One little tip on the latter: A copy of the Amateur Rules and Reg is all but a necessity.

The topic that brings the greatest criticism seems to be the new Communicator Class license. Not the creation of the class itself, but rather where to put them. My personal belief is that six meters would be an excellent spot. That band is a veritable wasteland all over the country, and one that we may possibly lose if we don't start populating it in vast numbers soon. A couple hundred thousand communicators there might just be a blessing in disguise, but there is an International Regulation against the issuance of a code-free license for any frequency range below 144 MHz. Since the U.S. is a subscriber to the ITU, we must live within this regulation.

Still, we are faced with the fact that we must either grow or "go away." However, if everyone from eleven meters suddenly shows up on two, where are we going to put them all? In Southern California, as well as many other large urban areas, the channel crowding has reached the point of saturation and people still keep coming.

The suggestion has been made to give the Communicator Class all of 220 including full repeater privileges, but with the OTP letter to the FCC pushing hard for Class E CB up there, with repeaters and rather high power level provisions, the entire question of the future of 220 may be a moot point by the time you read this.

There is though, in my mind, an obvious answer to the Communicator question that would make this class a self-limiting one. Simply, give the Communicator all the privileges as outlined in 20282, but make the license itself a short term non-renewable one. Let's say that the Communicator license be issued for a term of 2 years after which the licensee must up-grade to Technician. In that two years the individual will know if he or she wants to stay a radio amateur, and if so there is the incentive to upgrade.

In case you are interested, I feel that the same should hold true for the Novice class, though I go along with a five year license term for it due to the increased code speed necessary to reach the next plateau: General. In either case, Communicator or Novice, I feel that a limited license term would solve both the quantity and quality problem that is on everyone's mind at the moment.

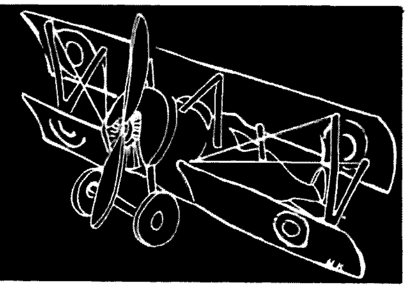
Another aspect of 20282, one that I personally feel needs consideration, is what I term the inequity of its "grandfathering." I simply believe that the right of the individual is far more paramount an issue than that of tradition. If you are going to "grandfather" one or two license classes and show them some form of special consideration, then the same consideration must be shown to all license classes and all amateur licensees. Lest we forget, tradition is a respect for the past and that the *tradition of tomorrow is what we do today*. The constitution upon which our country was founded guarantees equal treatment to all. I feel that we are the "all" regardless of what class license we hold and that to play favorites is not exactly being fair.

I can see no reason to re-examine half the existing amateur licensees just for the sake of re-examination itself. If someone is operating his or her

Continued on page 144

Autobiography of an Ancient Aviator

W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230



I had every intention of diving on the herd as soon as the cowboys had it rounded up, though sometimes this resulted in bullet holes in the wings.

CARLSTROM INCIDENTS

As I promised last month, here are a few of the Carlstrom Field incidents that I think are more or less interesting.

One morning early in March at my 8 o'clock flying line briefing, my instructions were to fly about 10 miles north of Carlstrom and practice loops, each starting at 3000 feet, and keep it up until I could come out of them going in the same direction from which I had started. After this I was to practice barrel rolls without losing much altitude. I was alloted an hour.

Since I had been practicing these maneuvers for some time, and was able to accomplish them satisfactorily, I did a few loops and rolls and then watched some cowboys herding some cattle on the prairie below. I had every intention of diving on the herd as soon as the cowboys had it rounded up. The results of this were always the same – cattle going in all directions and cowboys shooting at the ship. Once in a while you might get a bullet hole or so in the wings.

I was circling and watching the herding procedure out of the left side of the ship when, all of a sudden, there was a sharp jolt. I looked around to see what had happened and found that I had a full grown whooping crane caught in the rigging wires of my right wing. It seemed to be quite dead and the impact hadn't had any effect on the way the ship flew so I headed back to Carlstrom.

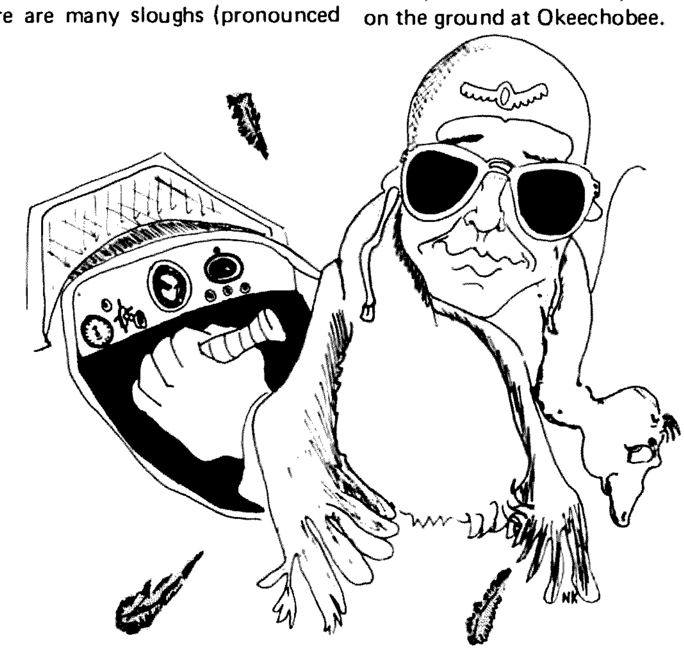
Whooping cranes were not an "endangered species" then. Several times I had observed one flying and had gone over to get a closer look. The crane would usually turn its head and look at me but would never miss a beat of its wings or change course. When these cranes started to go somewhere, they wouldn't let a little thing like a plane change anything.

However, since I had killed one inadvertently, I thought I might as well make the most of it. So when I got back to Carlstrom I put the crane in a barracks bag and took it home. That evening I plucked and cleaned the bird and put him in the oven to roast. Right then I found out that whooping cranes are not an "endangered species" because people kill them for food. This one was so tough that, after hours of cooking, you couldn't stick a fork in him. In addition he smelled so bad while cooking that even the neighbors complained. He joined his feathers in the garbage can.

Then we would short cut the business of frog catching by tossing a hand grenade or two into the water.

One of our forms of entertainment at Arcadia was frog's legs cookouts. There are many sloughs (pronounced slews) in the prairie east of Carlstrom Field. These are shallow streams inhabited by frogs and once in a while a gar. The frogs were very large and in great quantity. So Cleo (my wife) and I with two or three sergeants and their wives would drive out to one of the sloughs and rig a place for a cooking fire. Then we would short-cut the business of frog catching by tossing a hand grenade or two into the water. This would stun the frogs long enough to enable us to net them easily. Then cutting off the legs and skinning them was an easy job. Of course they were delicious dipped in corn meal and fried, together with roasted potato or yams and the best vegetables and fresh rolls we could get from the mess. Some kind of fruit for desert usually topped off the cookout. I might add that no party such as this would be complete without some of Sergeant Bunn's eau d' vie from his still in the enlisted men's mess kitchen.

After we had departed from Carlstrom one of the cadets made headlines in the local papers and got himself "benzined" (discharged) all in one maneuver. The first of several cross country flights in the curriculum was from Carlstrom to Okeechobee City, a distance of about sixty miles, and return. The outbound course was 90 degrees and the homeward bound course was 270 degrees with a small allowance for compass deviation and for the declination from true north which could be easily figured out ahead of time. I made this round trip on March 28th in two hours and twenty minutes including 25 minutes on the ground at Okeechobee.



On June 8th, however, Cadet White left Carlstrom at 8 am and, after two hours flying, arrived at Okeechobee. (Two hours to go 60 miles?) He refueled and took off for Carlstrom. He said he had a ceiling of about 1500 feet under some scattered cumulus clouds. For some reason he thought he would be safer above the clouds so he climbed above. He then flew for about two and a half hours until he ran out of fuel. When he broke through the overcast he was over the Big Cypress Swamp south of Immokalee, about a hundred miles south of Carlstrom. He was unhurt in his crash landing so he smeared his face and hands with engine oil to keep mosquitos off and started walking through knee deep swamp, saw grass, etc. The second day he came upon an old wagon trail which eventually led him to a Seminole village. After spending the night there the Seminoles drove him to Immokalee in a buck-board wagon. He was picked up there by one of the searching planes and flown back to Carlstrom. The part of his story that was the grabber and made headlines was his statement that he ate grasshoppers to keep alive on his way out of the swamp.

The Carlstrom "Benzine Board" decided that White might do better in some occupation other than flying so they sent him home.

Art Smith, a well known civilian pilot, arrived at Carlstrom with a new gadget that would enable the pilot of a plane to shorten his landing run by reversing his propellor after he had touched down. He demonstrated it several times and it functioned beautifully. It cut his landing run by about 60%. Airplanes didn't have brakes in those days. Then one morning when Smith was on a demonstration flight he came in to land. There were about twelve Jennies in a double line on the edge of the field near the hangars. Art came in low over the hangars and at the last second figured that he needed a little more power to get over the line of Jennies. He must have forgotten that the idling propellor was already in reverse for he gave the engine a quick "jazz." The result was that his Jenny came down like an elevator on top of the line of Jennies and made instant junk out of his ship and four others on the ground. No injury except to his pride. He was before his time on this one.

He accepted every drink that was offered and poured the gin into one canteen, scotch in another, bourbon in another, and mixed drinks in the fourth.

Lt. Wade was Post Exchange Officer and a very fine young man, but he had a problem: "John Barley Corn." With one thing and another, things finally got to the point where Major Ralph Royce, the Post C.O., found it necessary to put Wade "up the pole" (on the wagon) for two months. Immediately Wade got the nickname "BEVO" (a prohibition beverage that was supposed to taste like beer – eccck). Just as immediately Bevo solved his problem by appearing at cocktail parties, and other happenings where liquor was being dispensed, adorned with four army canteens attached to a G.I. belt. He accepted every drink that was offered and poured the gin into one canteen, scotch in another, bourbon in another and mixed drinks in the fourth. When the two months were over it was almost a week before Bevo was back on duty.

Next I'll have an account of my five weeks duty at Post Field and of my transfer to Kelly Field, near San Antonio, Texas.

AMSAT

Oscar 6 Orbital Information					Oscar 7 Orbital Information			
Orbit	Date (May)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (May)	Time (GMT)	Longitude of Eq. Crossing °W
11613	1	0141.4	75.6	A	2084	1	0046.1	61.4
11625	2	0041.3	60.6	B	2097	2	0140.4	74.9
11638	3	0136.3	74.4	A	2109	3	0039.7	59.8
11650	4	0036.2	59.4	B	2122	4	0134.0	73.4
11663	5	0131.1	73.1	A	2134	5	0033.4	58.2
11675	6	0031.1	58.1	B	2147	6	0127.6	71.8
11688	7	0126.0	71.8	AX	2159	7	0027.0	56.6
11700	8	0025.9	56.8	8	2172	8	0121.3	70.2
11713	9	0120.9	70.5	A	2184	9	0020.6	55.0
11725	10	0020.8	55.5	8	2197	10	0114.9	68.6
11738	11	0115.7	69.3	A	2209	11	0014.2	53.4
11750	12	0015.7	54.3	B	2222	12	0108.5	67.0
11763	13	0110 6	68.0	A	2234	13	0007.8	51.8
11775	14	0010.5	53.0	BX	2247	14	0102.1	65.4
11788	15	0105.4	66.7	A	2259	15	0001.5	50.2
11800	16	0005.4	51.7	B	2272	16	0055.7	63.8
11813	17	0100.3	65.4	A	2285	17	0150.0	77.4
11825	18	0000.2	50.4	B	2297	18	0049.4	62.2
11838	19	0055.2	64.2	A	2310	19	0143.7	75.8
11851	20	0150.1	77.9	B	2322	20	0043.0	60.6
11863	21	0050.0	62.9	AX	2335	21	0137.3	74.2
11876	22	0145.0	76.6	B	2347	22	0036.6	59.0
11888	23	0044.9	61.6	A	2360	23	0130.9	72.6
11901	24	0139.8	75.4	B	2372	24	0030.2	57.4
11913	25	0039.8	60.3	A	2385	25	0124.5	71.0
11926	26	0134.7	74.1	B	2397	26	0023.9	55.8
11938	27	0034.6	59.1	A	2410	27	0118.1	69.4
11951	28	0129.6	72.8	BX	2422	28	0017.5	54.2
11963	29	0029.5	57.8	A	2435	29	0111.8	67.8
11976	30	0124.4	71.5	B	2447	30	0011.1	52.6
11988	31	0024.4	56.5	A	2460	31	0105 4	66.2

FINDING OSCAR

The first ascending orbit for each day is given in the chart – this shows the time Oscar will pass the equator going north – and the longitude. Add 115 minutes for each succeeding orbit and 28.7° longitude. A world globe with a 4000 km radius circle around your QTH will show you the area within which you should be able to get Oscar. When Oscar is ascending on the other side of the world it will descend over your area – subtract 166° to get a rough idea of where it will pass – and add 29 minutes to get the time it will pass closest to the north pole coming around. With a little care you will be able to calculate your time of acquisition within a minute for each orbit.

AMSAT-OSCAR 6 and 7 ORBITAL DATA CALENDAR

In cooperation with AMSAT, Skip Reymann W6PAJ has published an AMSAT-OSCAR orbital data calendar containing all orbits for 1975 for both AMSAT-OSCAR 6 and AMSAT-OSCAR 7. Designed so that it may be hung on the wall, the calendar includes information on the operating schedules and frequencies for both spacecraft, and also the telemetry decoding equations. Also included is step-by-step information on how to determine times of passage of the satellites.

The orbital data calendar is available postpaid for $3.00 U.S. funds or 20 IRCs. Overseas orders will be shipped via airmail. Payment should be made to: Skip Reymann W6PAJ, P.O. Box 374, San Dimas, California 91773 U.S.A. All excess receipts over costs will be donated to the space program.

LETTERS

160

160 Mtrs needs people, *NOT* incentive(?) SUBBANDS!

Charles "Skip" Westrich WB8OWM
Canton OH 44709

ANYBODY SPEAK GERMAN?

After being a devout reader of your magazine for the past year and a half, I decided this would be a good time for me to let you guys know how much I am impressed with the caliber of your articles and magazine in general. Presently I am not an amateur but I hope that will change in the not too distant future. Wayne Green has taken the initiative to make this magazine very progressive with his various editorials covering many facets of today's so-called hush-hush topics. I feel that by doing so you have broadened the coverage of your magazine immensely. And by doing so, have most likely opened the doors of amateur radio to many that would not otherwise get into the hobby.

During the last couple of months during a discussion with friends of mine (non-amateurs by the way), topics have come up which have also been discussed in your editorials. I have recommended that they pick up a copy of 73 in order to get some facts about the subject discussed. The usual response is something like: "73, what's that?" or "Isn't that a radio magazine or something?" Well, after letting one or two of them read a magazine or two, I found it difficult to keep up with where my issues were. By the way, it is harder to find a copy of your magazine at the newsstand now. In a way I feel I have created a monster but at least it is more incentive to get that subscription I have been putting off. I don't know if it is sacrilegious or not for me and my friends to be reading your magazine but if other magazines are leery to get into the real topics of today, I guess I will have to be.

I guess the so-called bug has bitten me. In the back of my mind, I have thoughts about what to do with the tax money we get back this year. I have to admit my wife and I have different views on the disposition of this money. At present I am stationed in Germany. I have been a German linquist for about four years now and have just recently spent a year at the Defense Language Institute in Monterey, California. What I need is someone interested in a reciprocal arrangement whereby they could help me learn to be a "ham" and I could help them learn German, thereby opening a new world to both of us. Being here in Germany makes it hard to find an amateur down the block. Wayne Green, "I need help!" Maybe by printing this letter someone can help me get into this apparently fascinating hobby.

SP4 Kenneth E. Wigger
334-48-6711
HHB 1st BN 1st ADA
APO New York 09077

TWO CLODS

As a potential ham I have been reading with great interest your editorials and articles on the declining number of hams in the U.S. With this in mind I would like to relate to you two recent experiences I had.

At present I do not know any amateurs personally. While driving home from work one evening I took a different route than normal and noticed a rather elaborate antenna on top of a home about one mile from my house. As I live in the city I drove up the "common" rear driveway to further inspect this set up. Parked behind the house was a car bearing a license plate with the owner's call letters. I didn't want to invade the personal privacy of this individual by knocking on his door so I copied his call and looked him up in the Callbook. I then wrote him a nice letter asking him if he would recommend a local club or organization I could contact for help in my endeavor. I closed by thanking him for his time and enclosed a self addressed, stamped envelope for his reply. That was almost 5 weeks ago and to date I have not received a reply.

I repeated the same procedure 2½ weeks ago with a different ham — 3 blocks away with the same results — nothing.

Have I committed a cardinal sin? Is this considered a "no-no" among hams? I certainly realize that an entire group can't be judged by a few, but you will have to admit so far I'm batting 1000.

What is the best way to personally contact a ham? Complain about TVI?

Charles F. Super Jr.
Philadelphia PA

To the two clods who did not respond to Charles' polite request for info: Do you think that now, with other services looking greedily at our frequencies, is the time to alienate potential new amateurs? You have given ham radio yet another black eye . . . Wayne.

FRUSTRATED

My guess is that you will have a hell of a time picking out the most representative letter from a bunch of frustrated hams who have been sitting on the sidelines during recent weekends listening to a lot of CQ NR on the Novice bands. I'm one of them so just putting this note together is a good release for a pretty good head of steam that's been building for the last week.

I am prepared to agree that there are a lot of hams who love contests — there must be a million or so judging from what I heard every time I tried to get on the air. It takes a lot of guts to get on the air and chew the rag when you know you must be lousing up somebody's attempt to use the frequency to run up a score. Even if you have the guts, the likelihood of finding another brave soul around in all that mess isn't very probable. I even tried getting up at 3 am one Friday figuring my contest buddies would be asleep from exhaustion or have broken fingers by then but you better believe they are a tough tribe. CQ NR CQ NR DE **** came floating in on the headphones from all over the place.

Now the Novice bands aren't the most spacious frequency slices and to just about wipe them out for two weekends running plus all the time in between seems a bummer to me.

Suggestion — Why not run these contests on an alternate day basis with everyone getting a better chance to do his own thing? That way even the contest nut's family would get a chance to see him at least every other day and the rest of us would have something to do on a cold winter day besides writing frustrated letters to 73.

Carl E. Fogelin
Princeton Junction NJ

SCHOOL RULES

February issue pretty good. Satellite articles were extra fine. I have many school teacher friends and they are always looking for free classroom talkers. I went to my friend's 6th grade class with my 2 meter rig and my 40 meter monobander and a hustler whip. The kids were fascinated. A few will be on their way to Novice. If any of your readers try this, here are a few things I found make it go smoother.

1. Don't count on skip conditions to show off your rig unless you are super sure of the band.
2. Try to bring 40 meter gear as you will be certain to make a contact at least a few states away.
3. Two meter gear sounds like the police and fire department to them. They love it.
4. By all means, bring all the foreign QSL cards you can muster.
5. Get a sked so you will be assured of a contact or two. Kids get bored very easily waiting for your CQ response.

Larry Kahaner WB2NEL
Brooklyn NY 11229

DISGUSTED

My purpose for writing you is twofold. First of all, I want to compliment you on two excellent publications. I'm referring to *73 Magazine* and *Hotline*. These are the best publications I've seen yet for our hobby. I hope I may someday be able to add to your efforts by the way of an article of technical interest or just a story.

Secondly, I have completed composing a letter to the FCC concerning Docket 20282 and my disgust for the same. I found, by reading *Hotline* number 24 that you share the same, or practically the same, sentiments as I do. I personally feel that incentive licensing has seriously hurt the Amateur Radio fraternity and continued meddling with rules and regulations will not make things any better. I detest the petitions filed by outside groups, namely CBers, who have requested rules changes for their benefit. Perhaps, Wayne, a hobby class license in the CB band can be created as a prelude to Amateur Radio . . . *but no one thought of petitioning to change the CB license structure!* I cannot see lowering our standards for those who are unwilling to learn basic code and technical theory nor can I stomach the thought of greater discrimination among operators by employing several classes of licenses.

I know my single letter to Uncle Charlie won't change anything but I can say I tried to do something about it. Strength is in numbers. If you possibly can, Wayne, do what you can to persuade your readers to send comments on 20282. This menace can be licked by sending telegrams to Washington . . . or, better yet, Amateur radiograms. We must destroy this monster before it destroys us.

R. Perry Awe WA9KNT
Griffith IN

WHAT GIVES?

What really gripes me is the lack of CW on two meters. You know, if you've ever worked either Oscar 6 or 7 as I have been doing lately, the band is full of CW. But after a pass nobody is heard until the next pass. Nobody can tell me they can't get on because I know they have to use the 2 meter uplink for the 2 to 10 repeater. Then come contest time (Jan, June & Sept.) the band is full also. I've been calling CQ beaming to New England every night but no reply. Being an active Oscar user I know they're there. What gives? Anyway I'm on 145 MHz CW every evening, usually around 145.1 MHz.

Danny Clendening WA3WID
Northumberland PA

Dan, the answer is simple . . . when repeaters developed there was little need for serious DX stations on two meters . . . we could all do better from a mobile rig than we used to with big antennas and high power. Then came Oscar and even greater range was easily available without big towers and beams since a great many serious Oscar users found that their antennas worked just fine down near the ground. Okay, so who is there to work extended groundwave DX on two meters? FMers don't have the equipment for it . . . most Oscar users don't either . . . and that accounts for most of the activity on two meters. If you want to get two meter DXing perking again you'll have to start interesting fellows in the project. I had a great time with it in the early 60's . . . kilowatt . . . big beam up on a big mountain . . . worked out like gangbusters. Now I have a 10 watt FM rig for repeaters and am working on some low antennas for Oscar . . . Wayne.

MISFIRE

I receive three ham mags, but 73 is my only "cover to cover" reading. I note other people are having trouble with Trigger Electronics. I've been trying to get a refund from them for months.

Donald F. Schwab, M.D.
Frederic, Wisconsin 54837

THANKS (YOU'RE WELCOME)

By the way, the response to my ad in Caveat Emptor was excellent! I mailed out ad requests to all the major ham magazines (the BIG FOUR) at the same time, and 73 was the first to publish it. QST was second and CQ and Ham Radio have not yet printed it. Thanks for the good service.

Jim Stitt WA8ONQ
Middletown OH

SORRY, GUYS!

80 mph straight line winds on 10 Jan during 3 storms has put W9CGI off EME temporarily. We will re-build, but weather, money, and parts may delay us until summer sometime. We will keep busy on the gear in the meantime.

We would appreciate any note of our problems to your readers, who may have heard we were almost ready (we were) and would have been on 23 Feb. Sorry guys!

Dave Brown W9CGI
Noblesville IN 46060

H. P. Fischer VE3GSP
1379 Forest Glade Road
Oakville, Ontario
Canada

IC Call Sign Generator

Perfect code at the push of a button.

The sign generator about to be described is a low cost unit that uses conventional ICs in a straightforward circuitry. It generates your call sign in CW or RTTY code by decoding 99 time pulses with logic gates. The unit was originally designed to send my CW call sign at the beginning and end of a RTTY transmission, but it can also be used for automatic station identification in connection with a timer or for generating a "CQ" message in either code.

The circuitry covers a 8.89cm x 12.7cm (3½ x 5") circuit board and runs off 5V dc at approximately 250mA. All required components can be purchased for about $10 from the various suppliers that advertise in 73.

Circuit Functions

Fig. 1 shows a functional diagram of the unit. The circuitry consists of a time pulse generator, decoding logic and a reset switch. Fig. 2 shows a detailed picture of the circuitry involved.

Clock

A SN7400 Quad 2 input NAND gate serves as a gated oscillator. This oscillator generates a square wave at a frequency determined by capacitor C1 and resistors R1, R2. The oscillator functions if one or both inputs of gate 4 are LOW and becomes disabled if both inputs of gate 4 are HIGH. To initiate a call generation, one input of gate 4 is momentarily switched LOW to start the oscillator. Upon the first clock pulse, the second input of gate 4 will be set LOW through a circuit loop and oscillation continues until a stop signal is decoded and the second gate 4 input is set HIGH again. Since then both inputs to gate 4 are HIGH, the output of gate 4 will be LOW and oscillation stops.

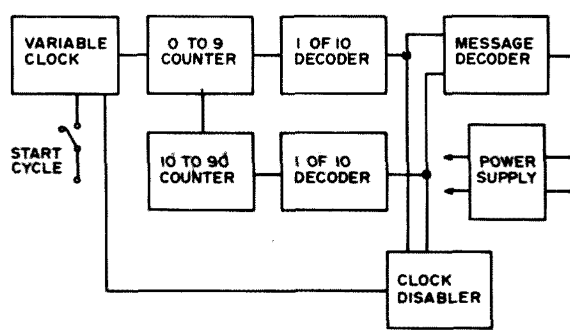


Fig. 1. Block diagram.

Counter and Decoder

The clock pulses are fed to a two stage binary decade counter with two SN7490 ICs. The first stage of this counter produces a binary 0–9 count and the second stage a binary 1–90 count. This is done by connecting the "D" output of the "1" counter to the clock input of the "10" counter. The binary 0–99 count is decoded to a decimal 0–99 with two SN7442 "1 of 10" decoders. Decoder 1 outputs the counts 0–9, and decoder 2 outputs 10–90.

Call Sign Decoder

The call sign is decoded from the decimal 99 time units generated by the counter system. After the most efficient decoding system is worked out as outlined in the

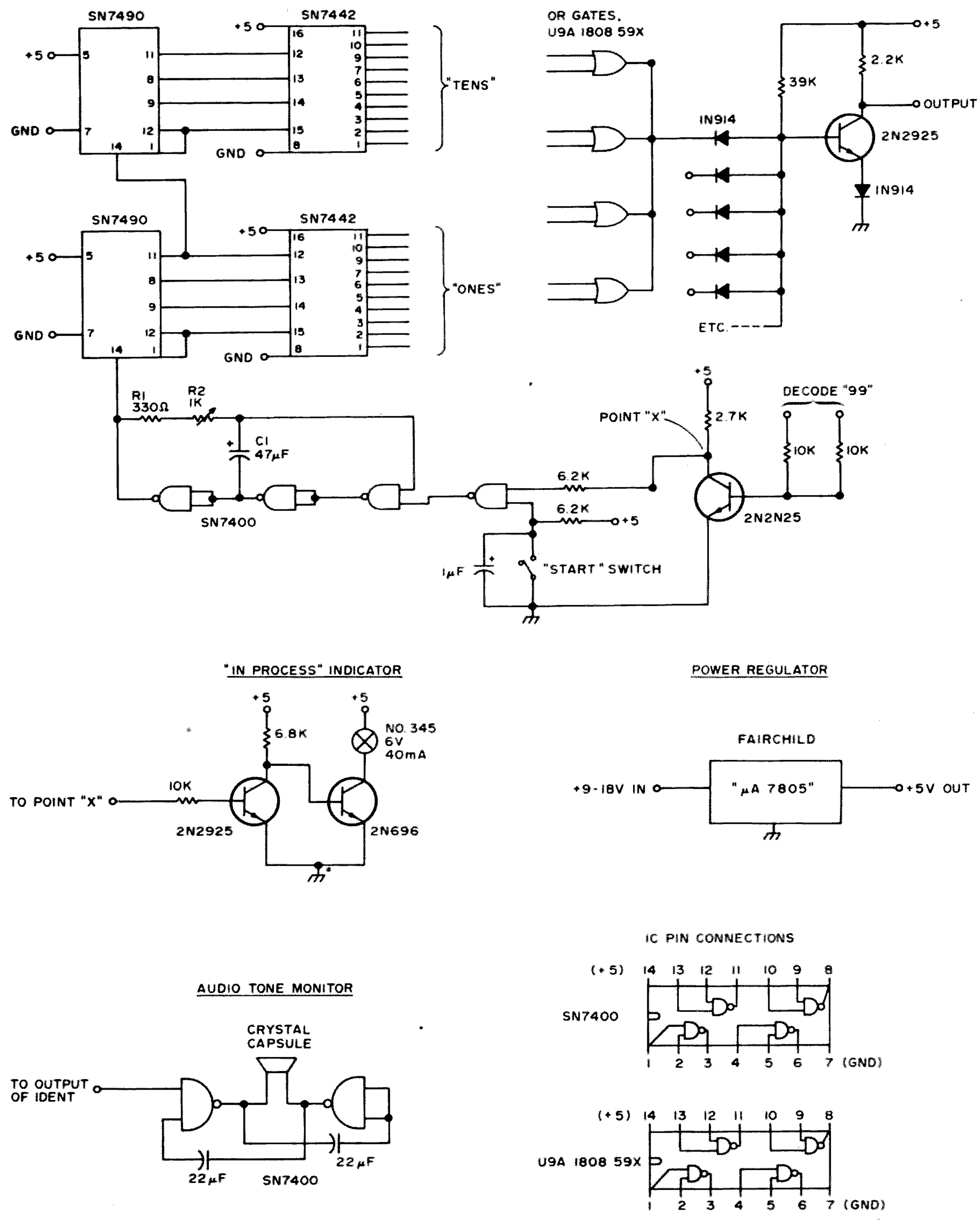
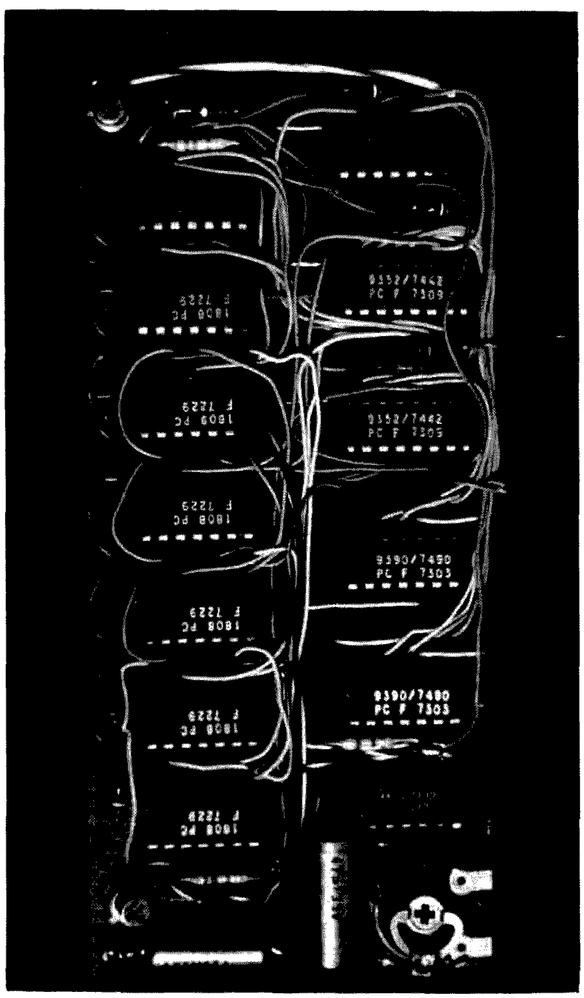


Fig. 2. CW identifier and circuitry.

"Decoding Theory" section of this article, the correct combination of "1" and "10" outputs are fed to a number of 2 input gates. Since the SN7442 decoders give a low output for a desired number, Quad 2-input NOR or OR gates are suitable for decoding the decimal counter outputs. These gates give a LOW output (OR gate) or a HIGH output (NOR gate) for two LOW inputs. TTL or DTL gates are suitable for this function. A suitable TTL OR gate is the SN7432; a suitable NOR gate is the SN7402. I used Fairchild DTL OR gates, the U9A-1808-59X, since they were readily available to me. If SN7402 NOR gates are used, the output of the gates have to be inverted to make them circuit compatible. However, the inversion can be made at the final output if the summing switch circuit is modified. SN7400 NAND gates, or SN7401 open collector NAND gates, can also be used if the decimal counter output is inverted



IC call sign generator.

with five SN7400 NAND gates or four SN7404 hex inverters.

If you use DTL 1808 OR gates, as in my circuit, the 4 gate outputs of one IC can be tied together without overloading individual gate output transistors. Ideally open collector OR gates should be used with one common collector resistor, so that all gate outputs can be tied together. In my circuit, groups of 4 gate outputs are fed through decoupling diodes to a summing-switch to give the final output signal. If open collector gates with a common collector resistor are used for the decoding function, the isolation diodes and the summing switch are eliminated.

Cycle Completion

The decimal counter output "99" (or any output of your choice) is decoded to give a signal that disables the clock. At this point of the circuit, a more complex gating system may be installed to permit additional clock enabling/disabling functions.

The "start" switch can be a single pole, 3 position switch which makes a momentary contact on one side and a permanent contact on the other side, permitting single or continuous message generations.

"In Process" Indicator

The schematic shows a circuit addition which turns an indicator lamp ON while the call generation is in process.

Power Regulator

The unit runs off 5V dc at approximately 250mA, although the current consumption varies with the number of ICs used. I used a uA 7805 power regulator chip to make 5V dc from an unregulated 12V dc source. With this regulator, the dc input voltage may vary between 9 and 18V. The regulator chip must be heatsinked.

Call Decoding Theory

The call sign is written up in code and deciphered into LOW and HIGH time pulses as shown in the example of "de VE3GSP" (Fig. 3). To determine the number of time pulses required for a call analyze the call as follows: A dot equals 1 time unit, a dash equals 3 time units, elements within

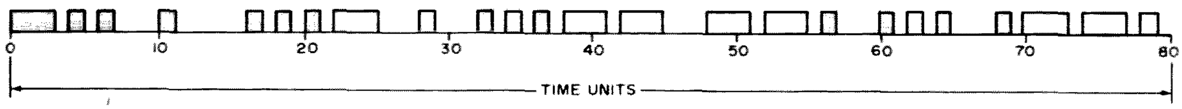


Fig. 3. Pulse train.

one character are separated by one time unit, characters within the same word are separated by 3 time units, and 2 words are separated by 5 to 6 time units. Thus, the 99 time units are decoded according to the call code to give a LOW or HIGH logic level.

To recognize the optimum decoding functions and to determine the most efficient decoding circuitry for your call, draw up a 10 by 10 matrix, Fig. 4, and fill the matrix squares with LOW or HIGH outputs as determined from the pulse train, Fig. 3. The first vertical column shows the output levels for the time pulses 0 to 9, the second column 10 to 19, the third column 20 to 29, etc. Once this is drawn you may discover certain shortcuts that are possible when you decode a call. First, count the number of LOWs and HIGHs required for a call and decode the lesser number of the two. The final output may have to be inverted, but you nevertheless save on the number of decoding gates. Also, other patterns in this matrix may prove to be of major advantage, such as the 7th horizontal line in the author's call, Fig. 4. The whole row turned out to be the same output level and it was possible to decode this row with a single gate (¼IC), by tieing both gate inputs to the 7 of the decimal "ones" counter output.

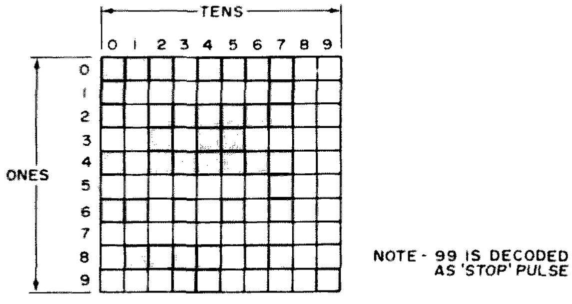


Fig. 4. Matrix Table.

Call Sign Extremes

Obviously, the number of time pulses to be decoded and the number of decoding gates required will vary from call to call. The message "de K5EE," is probably the shortest on the North American continent, requiring only 46 time units. Twenty HIGHs have to be decoded, which requires 20 2-input (5 Quad 2 input) ICs.

The message "de WBQQQ," is likely the longest there is, requiring 104 time units. In cases where the required time pulses exceed 99, the time pulse generator has to be extended to count to 109 or 199, and the decoding becomes more difficult.

Alternate Decoding Functions

The system can also be wired to generate a continuous train of "CQs" in CW or RTTY code. If a 20-pole, 2 position switch is added to the circuit, the system can be used to generate different messages or codes by switching to the next set of decoding gates. If RTTY code is desired, the clock speed must be adjusted accurately to 450Hz (22ms). As each character requires 7.5 (8) time units, the message "CQ de VE3GSP," can be generated requiring 96 time units. Using the 20-pole, 2 position switch, one decoding function may generate "de VE3GSP," plus a return and line feed character (88 time pulses).

Circuit Options

Fig. 1 shows the option of an "in process" indicator light included in the circuit. If an audible tone monitor is preferred, a SN7400 IC can be wired as a gated oscillator, supplying a low power speaker or crystal capsule with an audio tone.

Two different clocks may be used in the circuit, e.g., one low speed clock for CW call generation and a 450Hz clock for RTTY character generation. The clock speed can be changed by switching different values for C1 and R1+2 into the clock circuit.

Conclusion

This unit is easy to build since it uses only one type of decoding gate. It functions beautifully and there is nothing nicer than pushing the "ID" button at the end of a transmission and listening to a perfect code signal.

...VE3GSP

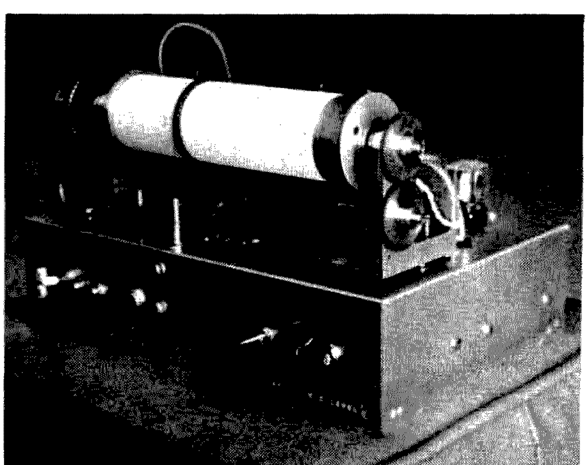
Edwin A. Reed K6IGC
1092 West 17 Street
Upland CA 91786

Faxing SSTV

Hard Copy of Slow Scan

It has been my desire to build a slow scan hard-copy machine ever since I got my first fax unit. It seemed to me that a conversion could be made that would do this. Here, then, are the results of that effort.

The device utilizes a regular Desk Fax unit, available for $10 to $15. I used only the mechanism, the ACK button and the power transformer. I chose not to use vacuum tubes in order to save power and to keep the size down. Also, I wanted to explore the use of transistors with high voltage circuits.



Front view of slow scan hard-copy machine.

Since it is not the purpose of this article to provide "build this" information, I will not go into construction details. Instead I intend to show what can be done with one particular conversion, and to explain the operation of such a machine. If anyone wishes to copy the unit, he should take heed that it is only for advanced builders. Much machine shop work is required to build special brackets, bearings, and so forth.

The unit is semi-automatic, and will make a fax type picture from slow scan in less than 25 seconds. If your timing is right you can get a copy in about 17 seconds! This amounts to one frame of synchronizing, and one frame to "burn" the picture. The picture quality is quite reasonable and the unit is capable of 8 shades of grey.

After a basic set up adjustment or two, the operation requires pushing one button until a "run" light comes on; after that it is automatic, and shuts itself off after the copy is finished.

The normal operating procedure is as

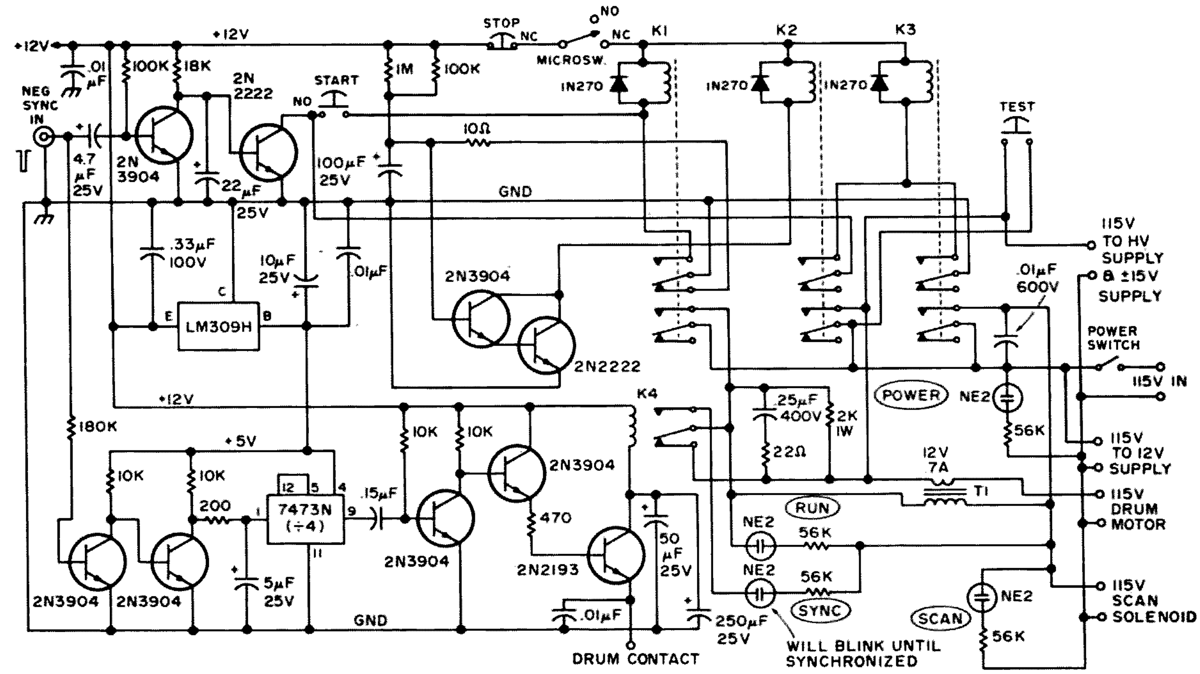


Fig. 1. Logic and control. (All relays shown in relaxed condition.) Note: T1 has windings phased to boost motor voltage by 12 V. All resistors ¼ W unless marked. All capacitors 200 V unless marked.

follows:

1) Turn on power switch and "paper up." ("Contrast" all the way down.)

2) Place stylus carriage in start position at left side of drum.

3) Press *test* button, and hold while setting stylus voltage to approximately 450 V. Release test button. (Motor will run while button is depressed.)

4) Turn up *contrast* all the way.

5) When a slow scan picture is being received on the monitor, press the *start* button until the *run* light comes on at the next vertical sync pulse. The motor will start, and synchronizing will begin automatically. The *sync* light will blink until the

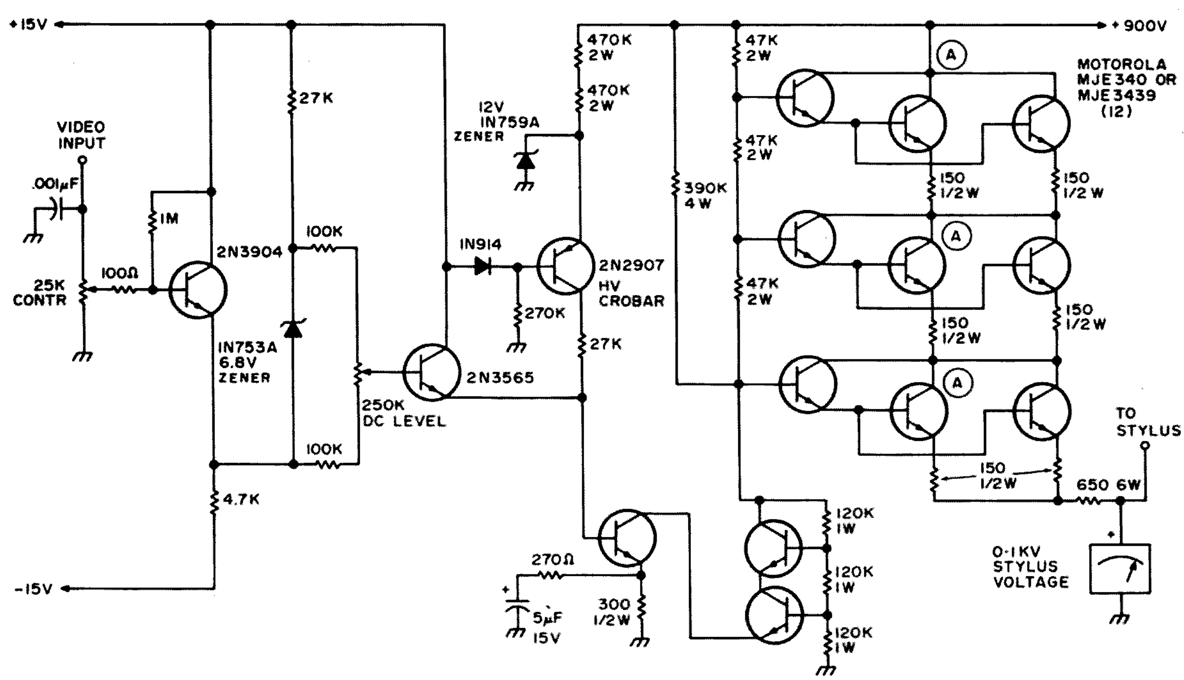
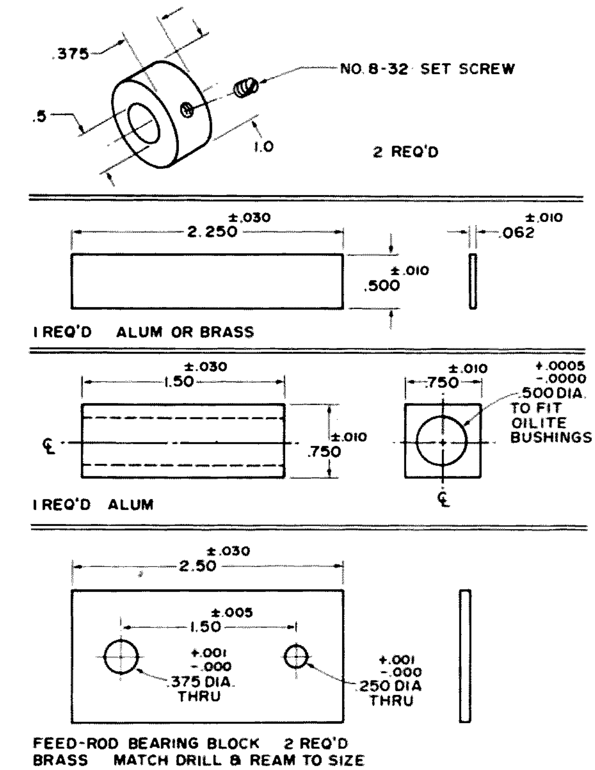


Fig. 2. Stylus driver. All resistors are ¼ W unless marked. (A) transistors are mounted on the circuit board by their leads and a 3/4" x 1½" x 1/32" aluminum heat sink is bolted directly to the transistors in each group of three (heat sinks).



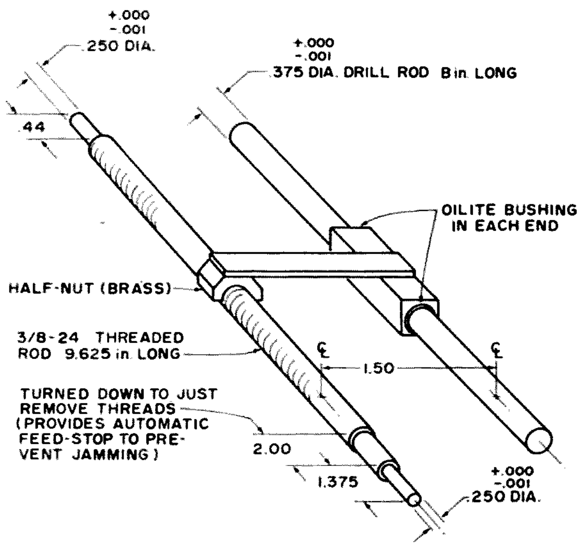


Fig. 3. Carriage feed mechanism. When stylus carriage reaches end of travel, the half nut will run off the threads and stop feed. Also, the carriage will contact a micro-switch to remove drum motor power and cut off stylus power (this will stop "burn").

motor is in sync with the incoming 15 Hz horizontal sync pulses. K1 is locked up when the motor starts.

6) After about 7 seconds, the timer circuit will energize K2, locking out the sync circuit and enabling K3.

7) At the next vertical sync pulse, K3 will lock up and start the scan by energizing the scan solenoid.

8) At the end of the scan, the stylus carriage will press the micro switch causing *all* relays to drop out, the motor to stop, and the stylus voltage to be removed.

The picture can now be removed from

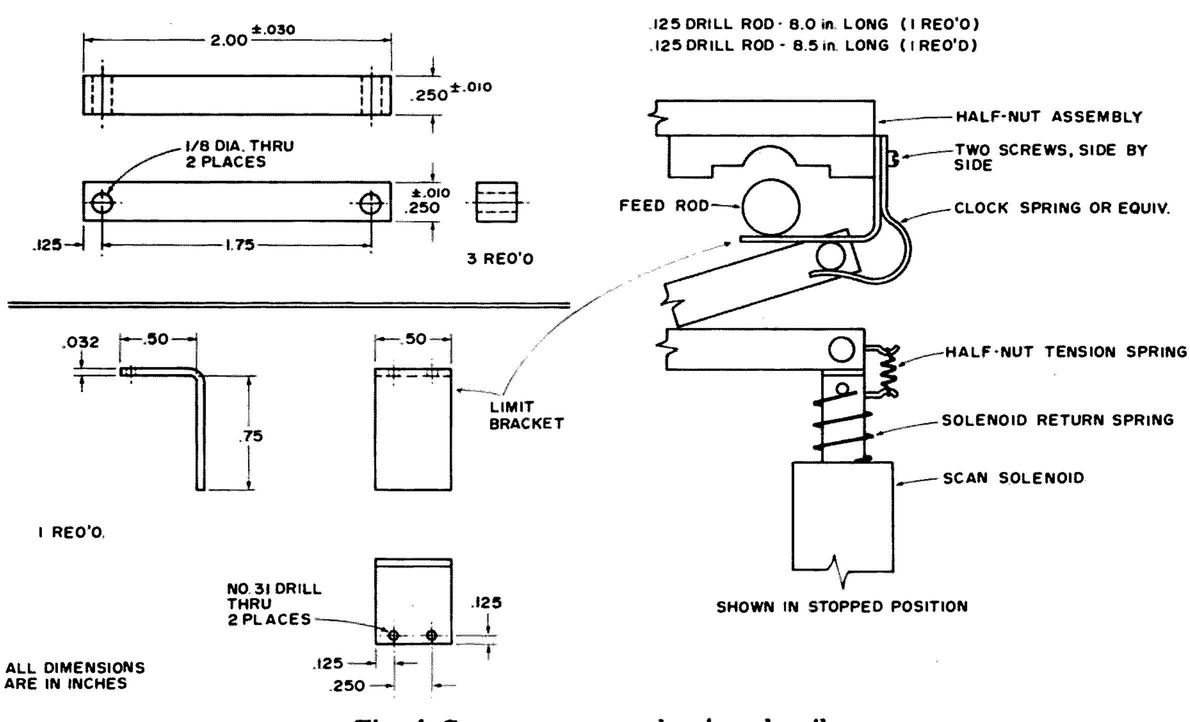


Fig. 4. Scan-engage mechanism details.

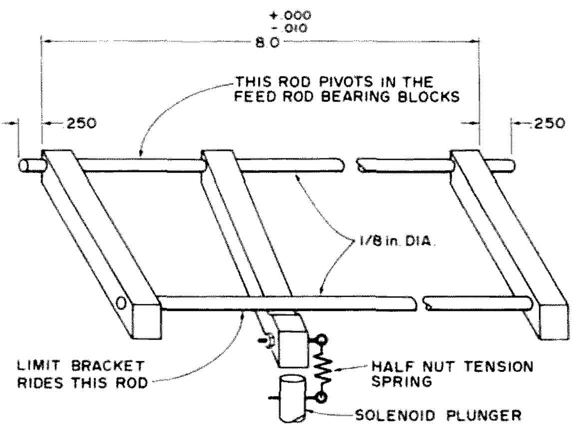


Fig. 5. Scan-engage mechanism.

the drum and a fresh paper installed. Of course, depending on picture content, contrast, or receive conditions, a slight readjustment of the contrast and dc level controls may be required for best results. The picture quality is not as good as a Polaroid picture from the monitor, but at about one cent per copy, they are quite acceptable.

Since the regular Desk Fax paper is too small and also too sensitive to voltage, I use the larger 12" x 19" fax paper cut down to approximately 5-5/8" square. This yields a 5-1/2" picture. Due to the lack of resolution in slow scan, a larger picture would do no good.

At present the drum motor uses the 60 Hz line for synchronism. As a result only "live" copy from a slow scan camera will stay in perfect sync. However, I have been toying with the idea of a servo system employing a phase locked loop to run the drum motor in continuous sync with the horizontal sync pulses, but *that* is quite another project.

The photo of W6HFU's son, Rick, results from a tape recording of an "off the air" slow scan picture. It can be seen that the "skew" or "wiggle" shows up in the horizontal sync pulse as recorded on the copy. The hard-copy machine starts off "in sync," but the tape recorder speed *continues* to drift after sync lock-out.

The drum sync circuit was, perhaps, the most difficult part of the conversion. At first I tried to sync directly with the 15 Hz pulses, but I quickly discovered that the motor could not recover fast enough between sync pulses. As a result, the motor, quite often, would not come up to speed.

So, I did the obvious. I used a 7473 dual flip-flop IC to divide the 15 Hz by 4. The original fax unit used 20:1 gearing. This unit uses 4:1 gearing. So, instead of one pulse every 20 revolutions, I was getting one pulse every 4 revolutions! Installing the ÷4 circuit reduced this to one pulse every 16 revolutions, pretty close to the original. It seems to work quite well with this set up.

As a point of information the video and sync signals are obtained from the robot monitor. The video is from across the R42, contrast control, and the sync from the collector of Q2. A pair of RCA phono jacks

Live "off the air" from WB6ISL.

Live "off the air" from W6HFU.

Copy from tape recording of transmission by W6HFU of his son, Rick.

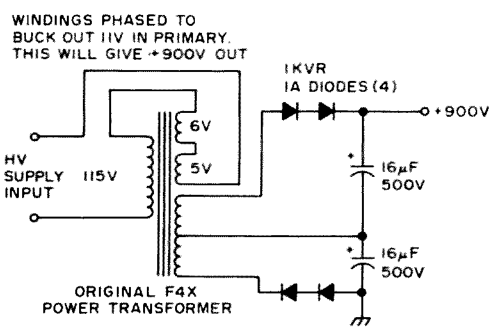
may be installed in the rear of the monitor. This modification will not affect the normal operation of the monitor.

As for mechanical modifications, the motor mounting holes had to be lowered about 5/16" to allow the larger pitch diameters of the new gears. The entire stylus carriage and motors were removed from the original unit. The stylus holder was retained.

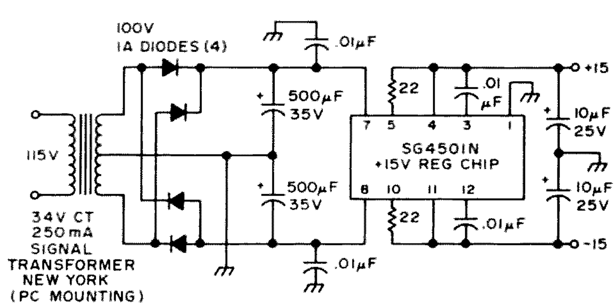
The main drum shaft required a hole in the right end to allow a short piece of ¼" drill rod to be pressed in. This provides mounting for one of the feed drive gears. 3/8"X24 threaded rod with each end turned down to ¼" diameter provides the "lead screw" to drive the stylus carriage. The right end allows mounting the other feed drive gear. These gears mesh and allow the drum to drive the lead screw at the required 900 rpm. This will move the stylus carriage 5" in 8 seconds.

The stylus carriage is a small block of aluminum with a hole drilled through it and a pair of 3/8" (i.d.) bushings pressed in the ends. This rides on a short section of 3/8" diameter ground rod. Both the "lead screw" and the ground rod are mounted in mounting plates that maintain alignment and allow bearing action for the 3/8"X24 lead screw. The stylus assembly is modified and mounted to, but insulated from, the same aluminum block. This forms the stylus carriage. An arm extends toward you from the stylus carriage on which a "half nut" (3/8"X24) is mounted. This forms the "clutch" to engage or disengage the scan. The *scan solenoid* provides control of scanning.

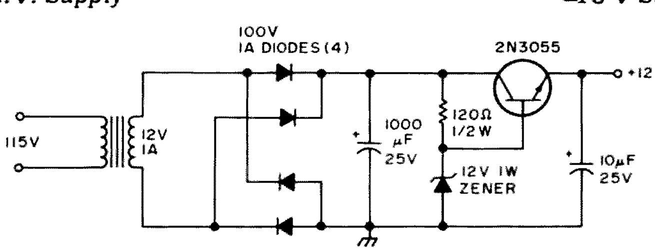
A new, longer drum had to be fabricated. I used a section 7¼" long of 2" (o.d.) brass tubing. However, aluminum tubing would be better, because it is lighter. The original drum is disassembled, and the ends are used again with the new drum.



Stylus H.V. Supply



±15 V Supply



+12 V Supply

Fig. 6. Power supplies. Note: 12 V supply comes on with pwr sw. ±15 V and H.V. come on only in "test" or "run" conditions. This is necessary in order to prevent shock at the stylus!

Because of the type of synchronous motor employed, a flexible coupling must be used between the drum shaft gear and the drum. If this is not done, the motor will not attain synchronous speed! I used some #12 copper bus wire, and wound about 9 turns around the drum shaft, driving one end with the set screw on the large gear bushing and bending the other end into the hole in the end plate of the drum. This is not the most satisfactory way to drive the drum, but at this point I was not being too fussy!

Finally a new stylus had to be made since the original was much too small. The stylus moves .0417" per revolution of the drum, so a hex wrench (.050) was ground and filed to provide a tip .041"X.010". This is the size that seems to work best. The space between lines is almost gone (but no overlap results), to cause a fine "second burn." I tried that too, but found the fine line "second burn" very objectionable.

The resultant copy is somewhat "grainy" due to the slight unevenness of the fax paper and the relatively large stylus required. However, for about 1¢ per picture, I think it is quite acceptable.

I hope the readers of this article enjoy it as much as I did building the piece. It has really been a challenge!

Partial Parts List

K1, 2, 3 – Archer #275-206, 12 V dc relay (Radio Shack)
K4 – Calectro #D1-974, 12 V dc relay (Olson Electronics)
Micro-switch – Archer #275-016 (Radio Shack)
T1 – Olson #TF-027, 12 V, .7 A (Olson Electronics)
Stop button – From original fax unit (ACK button)
Start and Test push-buttons – Olson #SW 452 (Olson Electronics)
Motor gear – Boston Gear, H2412R
Motor shaft bushing – Boston Gear, B-34-6
Drum gear – Boston Gear, H2448R
Drum gear bushing – Boston Gear, B-810-4
Feed drive gears – Boston Gear, G-146 (spur gears)

. . .K6IGC

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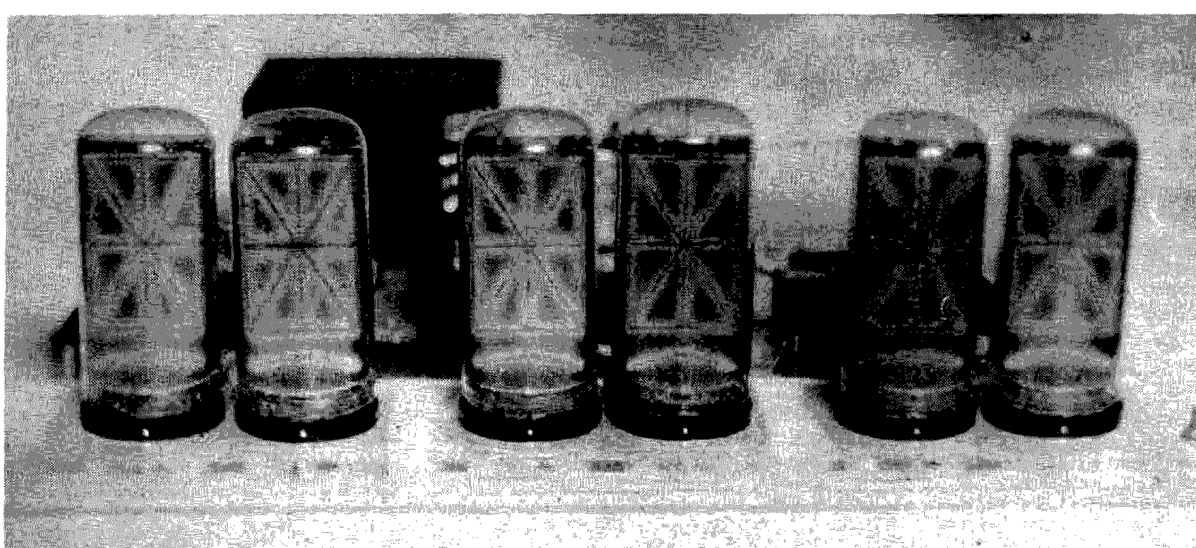
Fat Nixies for Chronometer Nuts

It seems as though every surplus house recently is over-supplied with giant nixie indicator readout tubes. These giant nixies are alphanumeric which means the alphabet as well as the digits 0-9 can be created (along with many other weird combinations). The best part is that these neon filled beauties are usually on sale at quite low prices . . . socket included!

These large nixie tubes (11 x 4½ cm) require the traditional 180 to 200 V dc, similar to that used by their smaller counterparts. The only disadvantage of using these large nixies is the high voltage supply that must be constructed, in addition to a low voltage source for the clock integrated circuit. The extra work constructing the high voltage supply is well worth it, as this beauty will really impress (dazzle) visitors to your shack, such as girlfriends, relatives, etc.

The great majority of clock chips (integrated circuits) presently on the market are of the scanning or multiplex type and are designed to work well driving the LED or fluorescent type readouts. In general these chips are all low voltage, high current devices. Usually, with the fluorescent type of readout, no transistor interface is necessary; however, with LEDs (current hogs) an interface is deemed necessary.



Front view of Fat Nixie Clock showing spacing of nixies and socket mounting in plexiglass base.

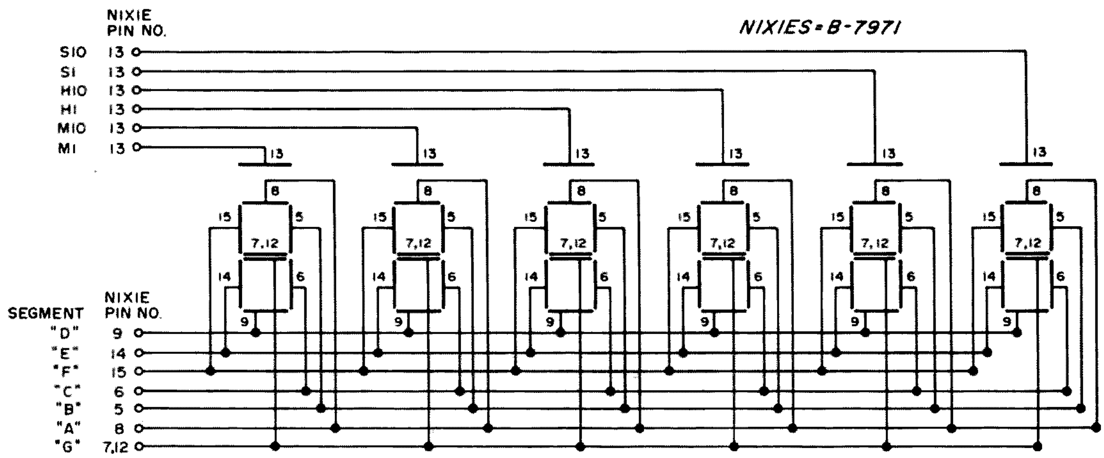


Fig. 1. Nixie multiplex wiring. Note: For "G" segment, pins 7 and 12 are wired together or in parallel. Pins 7 and 12 comprise "G" when both activated.

A high voltage isolating interface is definitely required to operate the giant nixies. By interface, we mean a device that isolates the voltage and current sensitive clock chip from the high voltage required by the giant nixie. At this point we might also mention that the average clock integrated circuit is quite a sensitive device and should be handled with care. Let the IC remain in its static protective foam or whatever until the project is complete and it is time to "plug" the IC into its socket. Even though some of these ICs have zener protected inputs, when you walk across an 8 cm thick plus rug, more than 30 kV can be generated. This voltage can be pretty rough on a $12.00 IC when you discharge yourself via one of the pins. It is wise to ground yourself prior to even touching a large scale integrated circuit. . .better yet is to place both the IC and printed circuit under water then insert the IC. This is almost a foolproof method of insuring that the IC will not be harmed by potential differences.

Anyway, we happened to have a spare National MM-5314 integrated circuit clock chip, so we decided to attempt interfacing it with the outside world of the giant nixie. After destroying many transistors, a circuit finally evolved that worked well.

The most critical part of the interface circuit turned out to be the digit enable circuitry. The digit enable pins on the MM-5314 emanate a negative pulse for digit activation. This is fine for turning on a small low voltage PNP transistor. In the case of a nixie, the digit enable transistor has to be able to handle the "full shot", or 200 V dc for the anodes. A single high voltage transistor in the digit enable system would reflect back excessive voltage to the MM-5314 enable pins. Therefore, a series of transistor switches were used, so as to isolate the MM-5314 from the high voltage and not invert the output switching. If you will notice the digit driver system in Fig. 3, a high voltage transistor (Q13) handles the

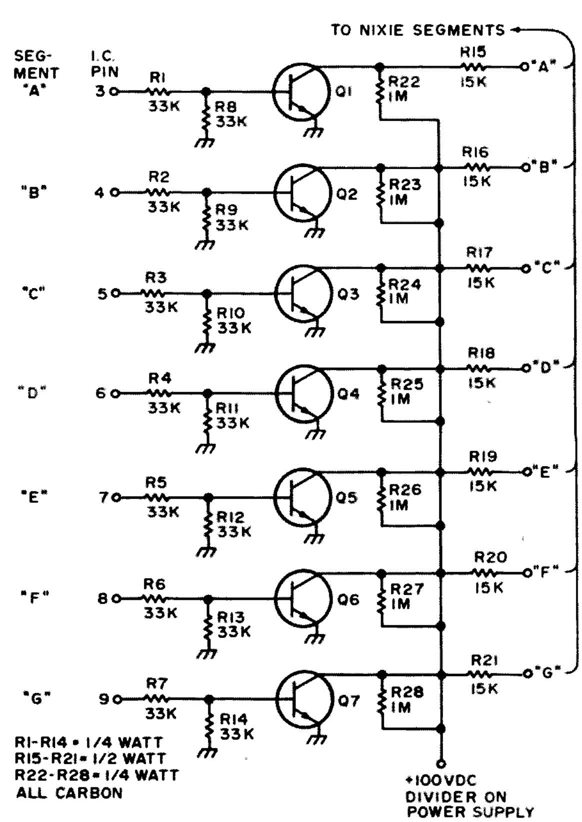


Fig. 2. Nixie segment drivers. Q1-17 – high voltage NPN silicon transistors (Radio Shack nixie driver transistors).

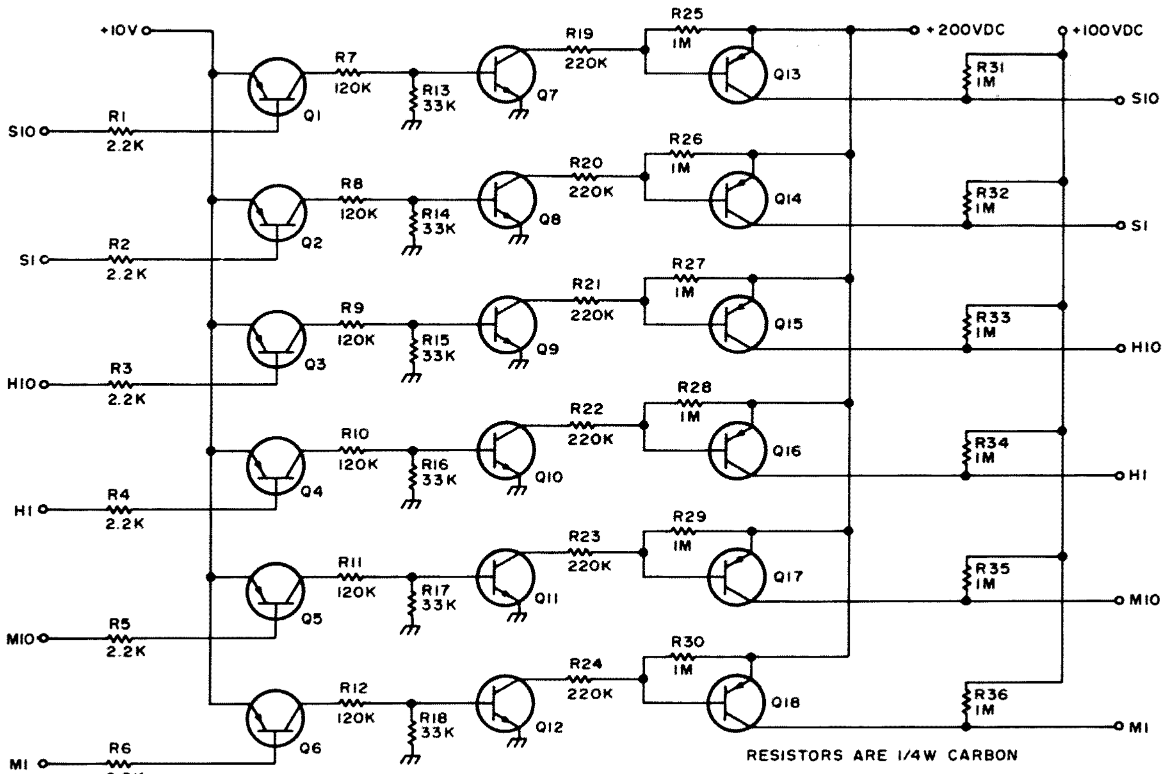
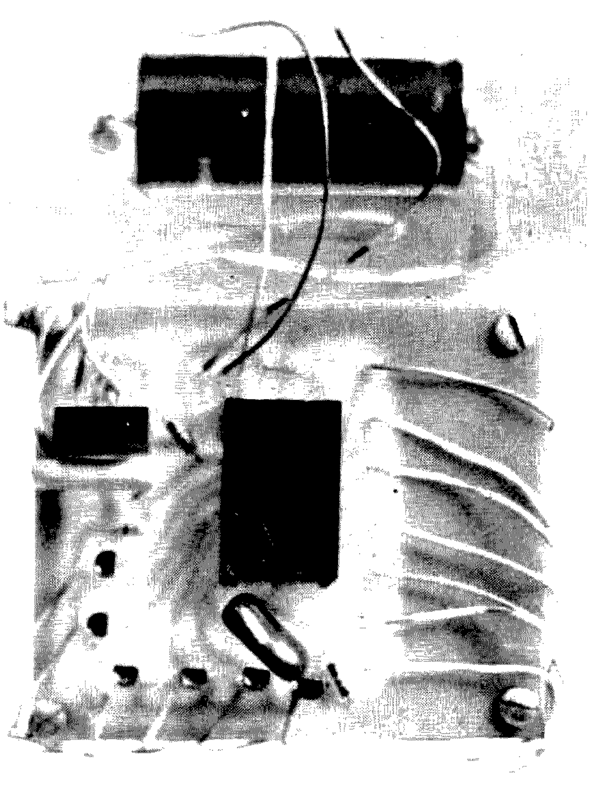


Fig. 3. Nixie digit drivers. Q1-Q6 – 2N4403 PNP silicon transistors, Q7-Q12 – 2N5058 NPN high voltage transistors (Radio Shack RS-2008), Q13-Q18 – Heathkit PNP silicon high voltage transistors.



IC socket board and pre-driver transistors for digits. All boards were mounted to the base with ½" standoffs.

actual switching of the 200 V dc for the anodes. About 150 V dc also appears at the base of this transistor which is reflected back to the NPN driver (Q7) which is also a high voltage type. The 220k resistor between these stages limits the current and drops the voltage as well. Q1 is a low voltage type PNP switching transistor which can then handle the voltage and current limited by the 120k resistor to the base of Q7.

From the standpoint of the MM-5314, the negative pulse given out by the digit enable pins turns on Q1 (PNP) through the 2.2k current limiting resistor. Q1 in turn, turns on Q7 (NPN) with a positive pulse and Q7 then turns on Q13 with a negative pulse. Q13 turns on the digit anodes at the proper time determined by the MM-5314.

The 1 megohm resistors carrying 100 V dc to the collector of Q13 act as a "hold off" biasing system for the nixie anodes so that they will not fire when Q13 is not in the "on" mode or activating that digit. The digit drivers run very cool in normal operation so heat sinks were not necessary.

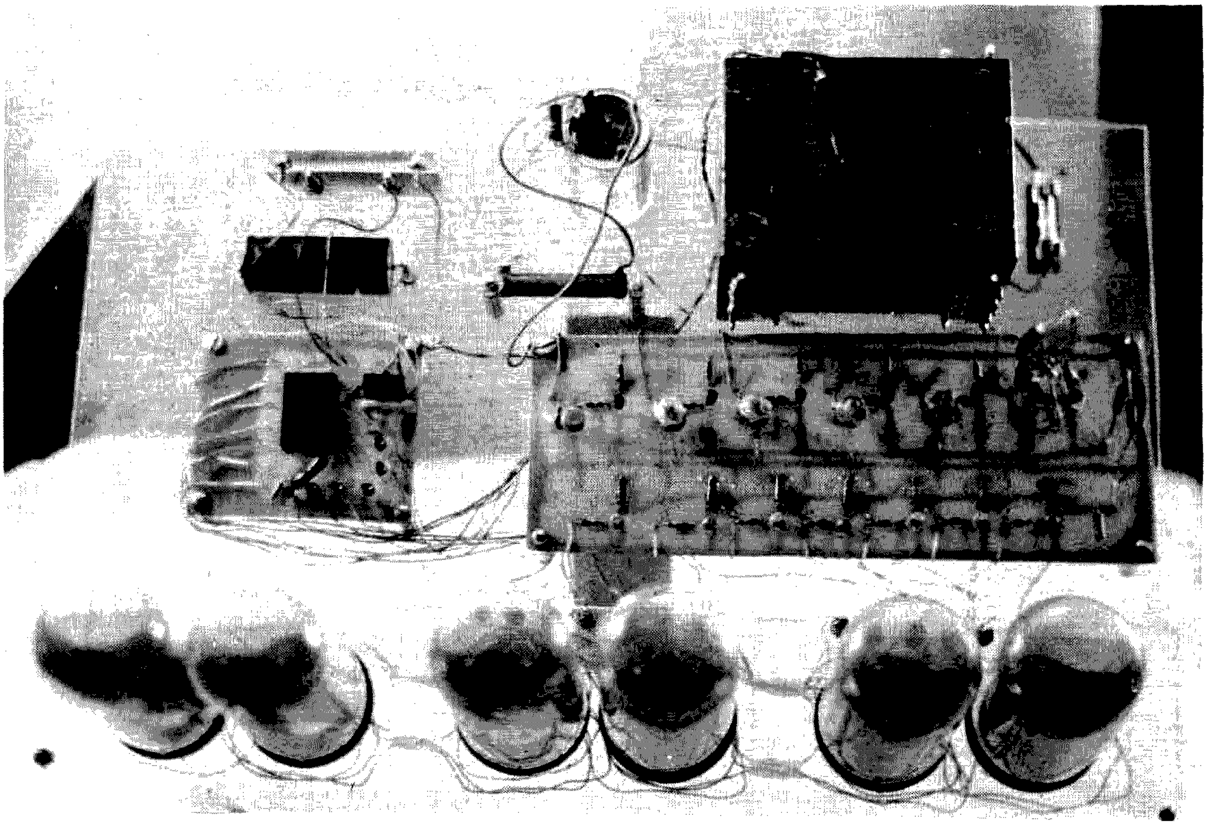
If you will observe Fig. 2, the segment enable system is not as complex. The great amount of high voltage isolation for the

MM-5314 is not as necessary here. The voltage drop through the giant nixie is great enough so that a common 140 V nixie driver transistor can handle the switching. The MM-5314 gives out a positive pulse for segment turn on, so an NPN transistor activates the segments.

Fig. 1 illustrates the multiplex wiring of the seven segment giant nixies. All of the same segments are wired in parallel. The digits or anodes are all individually wired. As the 5314 provides the switching data, at a rate determined by an external capacitor (C3), appropriate digits and segments are turned on. Multiplexing in our estimation is just another word for scanning in this application. At a very rapid rate, the individual digits are turned on in sequence. As each digit is activated in the scanning sequence, appropriate segments for that digit are also illuminated at exactly the same time. This rate of activation is much faster than the eye can respond to so that the entire 6 digit display appears to be continually "on". This is basically similar to a motion picture projector "fooling your eyes" by pulling and stopping the individual frames of film at a rapid rate. Let us take for example a time of 10:25:06. From left to right the first digit would be activated and the segments would indicate the number 1. In sequence, the second digit would activate and segments for 0 would come on. This will continue on until all digits are completed and it then starts over again. The correct time information is fed to the segments via the IC as necessary.

Should "leakover" occur on digits that are not illuminated during the timekeeping process, the scanning rate of the MM-5314 may have to be decreased. This is done by increasing the value of capacitor C3. If the scanning rate is too fast for the particular transistors used, there will be a tendency for digits to leak over. Should you decrease the scanning rate too much, the entire display will blink or pulse. It is not too difficult to find a happy medium so that the display will be stable with no leakover.

The mounting base for the six giant nixies was made from a strip of ¼ inch plexiglass. Holes were cut so as to mount the nixies and sockets in three groups of two so as to space the hours, minutes, and seconds. We left



Top view of clock and plexiglass mount for all components.

about ½" of space between the individual nixies and about 1" between the three groups of two. If you so desire, a pair of neon (NE-2) bulbs could be placed in this one inch space to create a colon between hours, minutes, and seconds. A current limiting resistor of about 100-250k would have to be placed in series with the neons and the high voltage supply. The neons could be cemented in a plastic strip in this space.

In Fig. 2, resistors R15-R21 are current limiters for the nixies. If the value is higher than 15k, the display brightness will decrease. Should you desire a brighter display than that provided by the 15k resistors, decrease their value. If you decrease these resistors too much, transistors Q1-Q7 may overheat and destroy themselves. Should you try a lower value, monitor the transistor case temperature carefully. With the 15k resistors, Q1-Q7 will run ice cold. Resistors R22-R28 are also "hold down" biasing resistors to prevent false ignition of the nixie segments.

The power supply for this clock is not complex and can be made up with a single power transformer. The transformer used must have a 6.3 ac/1 A filament winding and at least a 170 V high voltage winding. The 6.3 ac winding when rectified by a diode bridge and filter capacitor provides between 7.5 and 10 V dc which operates the 5314 nicely. The diode bridge raises the 170 Vdc for the nixies proper. Not a great deal of

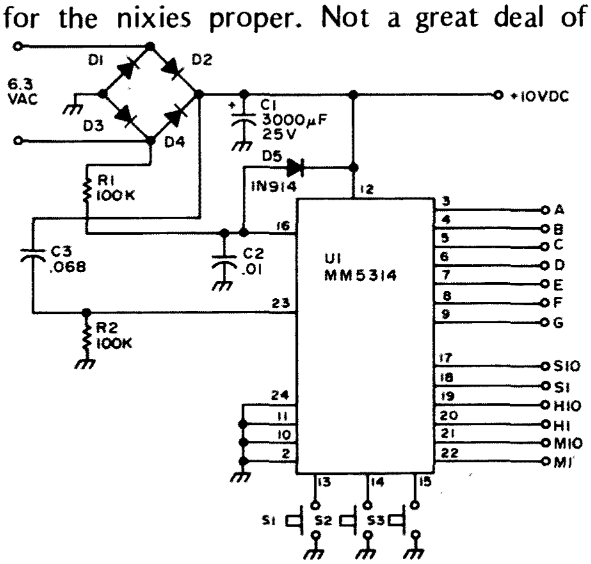


Fig. 4. Main 5314 circuit. S1-S3 – normally open push-button switches. U1 – National MM5314 clock integrated circuit.

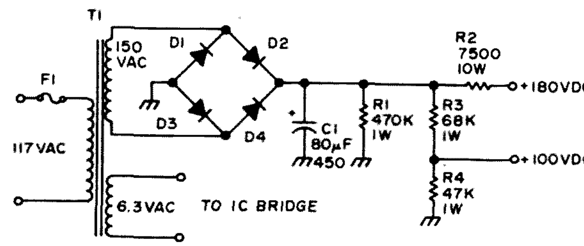


Fig. 5. Power supply.

filtering is required for the nixie high voltage supply as the total current demand is quite low. A small filament transformer and a line voltage doubler could also be used; however, the clock chassis will be hot and may generate a potential shock hazard. It is better to use transformers and isolate the clock from ground.

The accuracy of this clock is maintained by your local power line 60 cycle source. Plus or minus a few seconds per month is a good average for accuracy. I have noticed that the power companies must make corrections in their 60 cps frequency and the clock will also correct as the power companies compensate.

When first applying power to the "FAT" nixie clock, check first for signs of smoke. If all is well, all or a few digits will light and the seconds indicator will be counting. Press the "fast forward" switch and run the clock completely through an entire 12 hour sequence. We have noticed that when first applying power to this particular IC, its brain will be confused and it will read something like 35 hours 15 minutes and 12 seconds. By running it through a rapid 12 hour sequence, it straightens out the brain logic and it will keep accurate time from then on. Momentary power failures (less than 30 seconds) will not upset the IC timekeeping functions as it continues to run for a while on the low voltage filter capacitor charge.

Setting the clock is accomplished with the fast, slow and hold switches. With a little practice, it's a snap to set this clock. Make sure that you include a line fuse as this clock will be running on a continual basis.

PARTS LIST

Fig. 2.

R1–R14 33,000 Ohms, ¼ Watt carbon resistors
R15–R21 15,000 Ohms, ½ Watt carbon resistors
R22–R28 1 megohm, ¼ Watt carbon resistors
Q1–Q7 High Voltage NPN silicon transistors (Radio Shack Nixie driver transistor)

Fig. 3.

R1–R6 2200 Ohm, ¼ Watt carbon resistors
R7–R12 120,000 Ohm, ¼ Watt carbon resistors
R13–R18 33,000 Ohm, ¼ Watt carbon resistors
R19–R24 220,000 Ohm, ¼ Watt carbon resistors
R25–R36 1 megohm, ¼ Watt carbon resistors
Q1–Q6 2N4403 PNP silicon transistors
Q7–Q12 2N5058 NPN high voltage transistors (Radio Shack RS-2008)
Q13–Q18 Heathkit PNP silicon high voltage transistors, #417-295

Fig. 4.

C1 3000 microfarad, 25 volt electrolytic capacitor
C2 0.1 microfarad, 100 volt disc capacitor
C3 .068 microfarad, 100 volt disc capacitor
D1–D4 1N4002 silicon diodes
D5 1N914 silicon diode
R1–R2 100,000 Ohms, ¼ Watt carbon resistor
S1–S3 Normally open push-button switches
U1 National MM5314 clock integrated circuit

Fig. 5.

C1 80 microfarad, 450 volt electrolytic capacitor
D1–D4 1N4005 silicon diodes
F1 1 Ampere, 250 volt fuse
R1 470,000 Ohms, 1 Watt carbon resistor
R2 7500 Ohm, 10 Watt wire wound resistor
R3 68,000 Ohms, 1 Watt carbon resistor
R4 47,000 Ohms, 1 Watt carbon resistor
T1 120 V ac primary, 150 V ac secondary at 100 mA. 6.3 ac, 1 Ampere secondary.

...W2AOO

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Latest K2OAW Counter Update

Also Updates QST's Counter

After a quiescent period of a year or so, it seems that the season has re-opened on comments on the excellent frequency counter by Pete Stark K2OAW. The latest is the article in the November issue of 73 entitled "Latest Counter Update" by the original author, K2OAW himself. Seeing four photos of the counter I built included in the article (on page 29) blew my head up to at least double its normal size and prompted me to trot the old typewriter down to the local stationery store and have it cleaned so that I could get in my licks, too.

The original article was one of the better construction type articles I've seen and helped my counter to have a minimum of "birth pains." It did have a couple, though, and Pete put up with an awful lot in reading my letters (and I'm sure those of others) and answering them.

I added an extra digit stage to my counter to give it a 6 digit read-out instead of the 5 in Pete's counter, and also included "switched" decimal points which switch to the correct positions by means of added poles on the kHz-Hz and hi-lo switches. This necessitated at least one switch slightly more exotic than those usually available in stores; a four pole double throw miniature toggle switch. These are available from such places as Allied Radio and Newark Electronics, and nowadays are showing up in radio stores that have the IR switch display racks.

For ease of servicing and modifying, and also to permit construction in one of the small surplus CB (whatever that means) cabinets that I bought several years ago from Brigar Electronics through an ad in 73, I built the unit using all plug-in PC boards – 6 for the digits, one for the control circuits and clock and one for the input circuits. This meant that I had to make some double sided PC boards for the digit boards, a first for me. So I tried another "first," making boards photographically instead of the usual (for me) hand drawn circuit boards. EUREKA! It worked great!

I used seven-segment LED read-outs mainly because they look nice, are small and the power supply need supply only 5 volts. This led to another complication, as per Murphy's law – current drain. Being the world's most ignorant person when it came to ICs (at that time), I had no idea how much current the whole thing would draw, and blithely used the LED read-outs which use a pretty fair amount of current. Plus, I added the extra digit with its additional ICs. When I was finished I discovered that the whole thing drew something approaching 2 Amps, way over the limit of the LM-309K 5 volt regulator. I managed to get a Sanken S1-3554M regulator through another 73 ad. This has the same T0-3 case, but is rated at 5 volts at 3 Amps. It does a good job. The regulator still got quite warm, however, and I wanted to keep heat down as much as possible, so I replaced some of the ICs, but not all, with the low-powered versions. The 7490s in the clock divider section were all changed plus a few of the others. This helped a lot, too.

The above were minor things I did, but

there were two things which I feel considerably improved my counter. As Pete mentions in his update, different builders had different experiences with the input sensitivity. I don't really know how many millivolts it takes to drive the counter, but I found the sensitivity when using the prescaler to be quite satisfactory. The low frequency input, however, was something else again. It really needed a walloping signal to count. I fooled around with the 40673 and its associated circuitry, but never got the sensitivity to where I felt it was good. In an equipment report in another magazine there was shown the input circuitry of the HUA Model 1BC-1a frequency counter. This looked fairly simple and the report gave it a fairly good sensitivity rating, so I took out the original circuit and replaced it with that shown in Fig. 1. Things might work out differently for different people, but this improved the sensitivity of my counter to the point where I'm quite happy with the whole thing.

Pete also mentions in his update article the various problems (or lack of problems) different builders have had with stability of the oscillator. I wrote International Crystal about it, before building the counter, and they suggested that I not use an oven, saying that they felt their HA crystal (which Pete suggested) would do as well, or better. They were right, it does a fine job. Even so I still had a very slight drift. In K2OAW's original article he listed 2 capacitors in series with the crystal in the oscillator. These were a

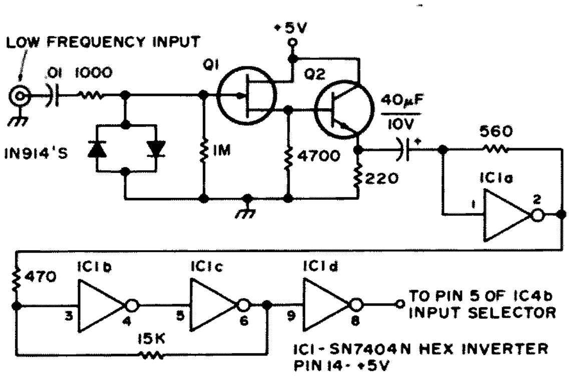

Fig. 1. Input circuit. Resistances are in Ohms; K = 1000 and M = 1,000,000. Q1 – MPF 102, HEP 802, Q2 – MPS 3563, HEP 720.

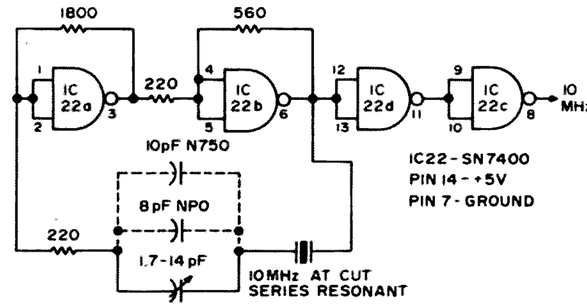

Fig. 2. Alterations to 10 MHz crystal oscillator. The two capacitors shown with dash lines replace the 33 pF capacitor in the original article. Some experimentation may be required to arrive at correct values.

1.7-14 pF trimmer and a 33 pF NPO in parallel. I changed the 33 pF to two separate capacitors, making a total of 3 caps in parallel, all in series with the crystal. Replacing the 33 pF cap with an 8 pF NPO and a 10 pF N750 really made the thing settle down. It just doesn't have any noticeable drift. Different crystals might mean different values, but a little experimenting will soon determine the correct ones.

Now that all is said and done, I really have a superb instrument. It will perform as well as a lot of commercial instruments (and better than some) available at far greater cost. It has been used by a number of the locals to align and put on frequency their 2 meter FM rigs, and also, in conjunction with a not too great signal generator (which it transformed into a lab instrument), to align HF rigs. On top of that, it looks great reading out the frequency of my Drake T-4X transmitter when I'm on the air. Incidentally, I used two input connectors instead of one, mounting one on the front and one on the rear panels. They're selected from the front panel by means of a toggle switch. This way I can leave the input from the T-4X connected to the rear jack and when I want to use the counter for test purposes, merely switch to the front jack. No taking the counter down from the shelf to disconnect and reconnect, along with the associated knocking over of things from the shelf (Murphy again!).

Now if Pete will only come up with a circuit for a 3½ digit Digital Multi-Meter, I'll have something to do for another year.

. . . WB2UKP

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How to Become a Famous Author

You can easily become a Big Wheel in amateur radio – a ham's ham, so to speak – by writing articles for amateur radio magazines. Read on, and I will tell you the secret of how to become a Big Author.

As you read the simple rules below, you will probably think I'm oversimplifying. "Impossible," you'll say, "it can't be that easy." Nonsense. Follow the foolproof method below and you can't go wrong. This approach is based on an actual case which has worked for others before you, and can work for you, too. To convince yourself, whip out your old copies of *QST* and *73 Magazine* and see for yourself.[1,2,3]

Rule 1. Start by deciding which magazine to write for. This is a crucial step, because you have to make a basic decision – what do you want most: fun, fame, or fortune?

Let's talk about the fortune first. The choice is only between a tiny fortune and no fortune. Of the four amateur radio magazines, three pay for their articles and one doesn't. The problem with getting paid for an article is that every dollar you get is one less dollar on the magazine's profit sheet.[3a] That means that the editor will examine your article that much more carefully than he would if he didn't have to pay you for it. That obviously won't do. And that brings in the fun part – you can't have much fun writing an article if you're constantly worried about doing a good job.

So the best bet is to give up the fortune – it's only a tiny one anyway – and concentrate on the fun and fame. You can have both by writing for *QST*. A long time ago I had a *QST* editor tell me that the reason *QST* doesn't pay for articles is that authors should consider it an honor to write for such a prestigious journal. He said it was like writing for one of the famous scientific journals. Obviously writing for *QST* will be a great honor and make you famous.

Rule 2. Pick the right source for your information. Everybody knows that electronics wasn't invented in a day. It's much too complex for everybody to be an expert on everything, and it's only understood that you will base your work on the work of those who came before you. It's obvious that you won't be inventing something new for your article – if you did, you'd be out patenting it and peddling it in the nearest electronics store.

As an author, you have an obligation to base your work on the work of other authors before you. After all, imitation is the sincerest form of flattery. But you must make sure you pick the right sources for your article. This one crucial point can make or break your article.

You may at this time have some qualms about just how much you can "borrow" from a prior article. Let me assure you that,

[1] To be a successful author, you have to learn how to write footnotes and references, so here's your first lesson:

[2] Arlo R. Eggensperger W2TJZ, "Frequency Counter – A Modular Approach," *QST*, January and February, 1975.

[3] Peter A. Stark K2OAW, "A Modern VHF Frequency Counter," *73 Magazine*, May, July, and September, 1972.

[3a] *What* profit? – Ed.

as long as you borrow from the right article, in the right magazine, you need have no such worries. A *QST* editor once wrote the following to me:[4,5]

> "I'm sure you realize that an article can't be rejected simply because it is similar to one which appeared in another publication. The exception would be, of course, in instances where the designs were original and patented. Most of the large corporations like GE, RCA, Westinghouse, and others hold the patents on almost any circuit configuration that is in common use today. Therefore, it would be most difficult to claim originality for anything but the collection of circuits we house in a cabinet."

See, you can borrow as much as you like from another article in a *magazine other than QST* without worry.

Your best bet would probably be to borrow from an article in *73 Magazine*. You see, the editors of *QST* and *73* don't always see eye to eye on a lot of things. That means that even if a *QST* editor should spot some similarities between your article and an earlier one in *73 Magazine*, he won't be too concerned. Most important, if in your efforts to do a good job you should get a bit overzealous and, heaven forbid, *copy* a bit of the original article from *73 Magazine*, the original author might complain to *QST*. But the *QST* editor will merely answer that an article can't be rejected simply because it is similar to one that earlier appeared in another publication. That gets you off the hook.

Rule 3. Pick the right article and subject area. Doing this crucial step properly will save you a lot of work later. Pick the right article to borrow from and your job is half done. There are several criteria to follow:

1. The original article must be at the right level. You can't achieve fame by writing about simple stuff. On the other hand, pick a difficult subject and you will be inundated with letters and questions, some of which you may not be able to answer.

2. The original article must be fairly long. It's hard to write an 11-page article by borrowing from a 5-pager. Takes too much work and cuts down on the fun. The best source article is one which is substantially longer than what you intend to write. That way you can pick and choose and thus really exercise your creative talents.

3. The original article should have a lot of diagrams. It's hard to borrow a lot of text, because you have to rewrite it or paraphrase it, and that takes thinking. Diagrams, on the other hand, can easily be disguised by following the simple steps in Rule 5 below.

The original article must be fairly long. It's hard to borrow an 11-page article from a 5-pager. Takes too much work and cuts down on the fun . . .

4. It must be about a reasonably popular subject. It's no fun writing something nobody will read.

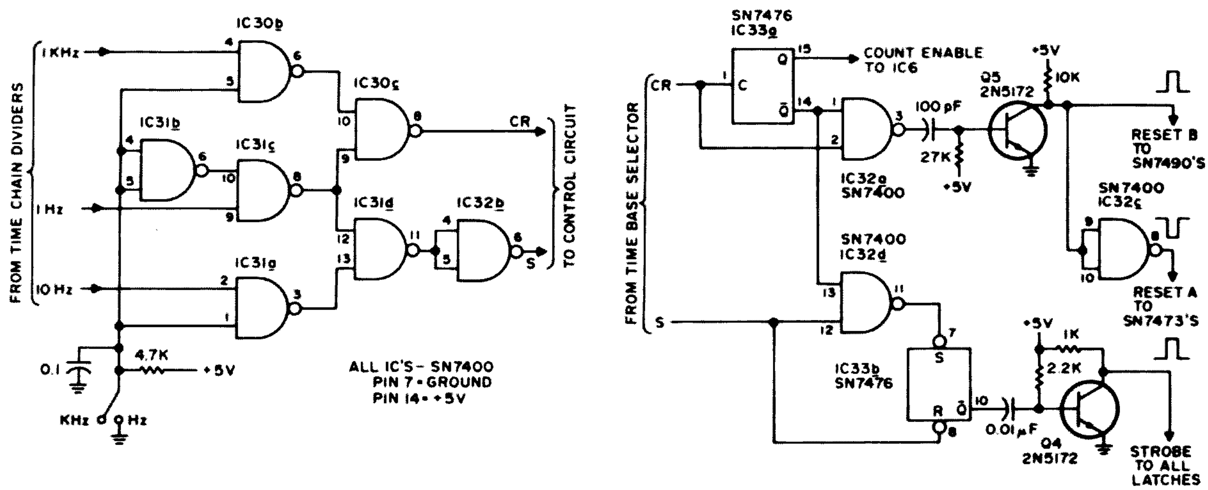
5. Of all the different areas of ham radio, something having to do with digital circuits is best, for a number of reasons. First of all, there are millions and billions of different ways of putting together a digital device, and they obviously can't *all* be patented by the big corporations. With luck, just by arbitrarily juggling things around, you might accidentally invent something new.

Second, because there are so many different ways of doing the same thing, everybody will *assume* that your circuit will be different from all the others, even if it should turn out to be a carbon copy.

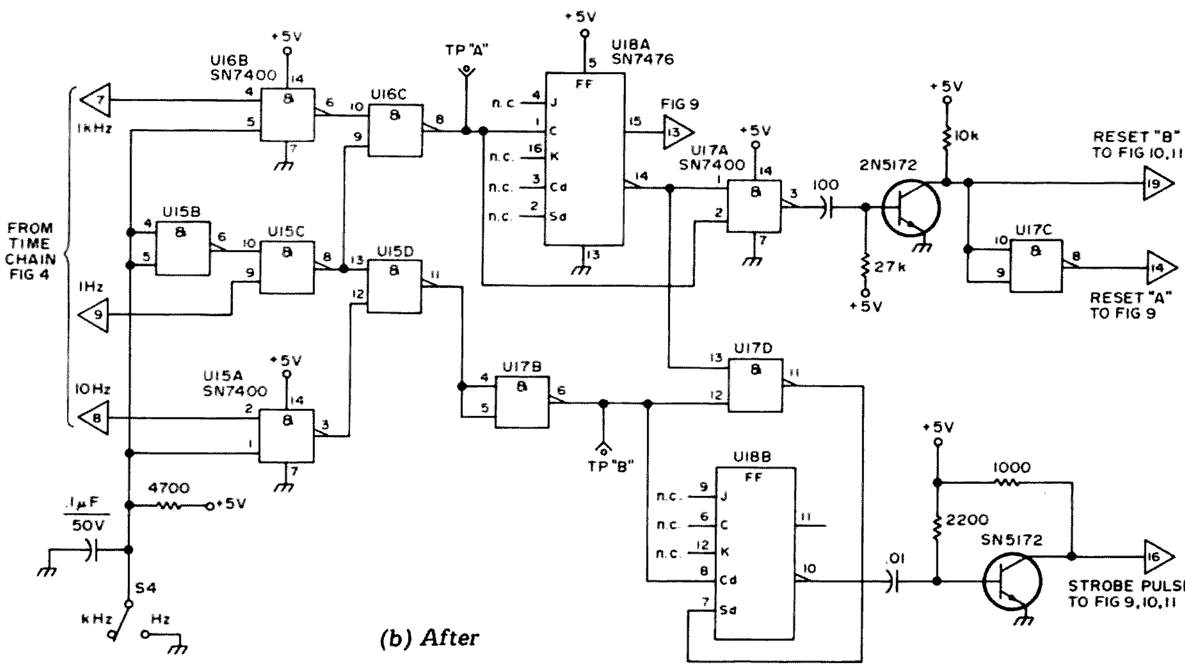
Actually, with digital circuits it is very easy to borrow an entire diagram from another article and dress it up so nobody will recognize it. You see, some time in 1974 *QST* changed to a new set of digital symbols which are completely different from those used by almost every other magazine. For example, one of the simplest logic elements is a NAND gate. Everybody else draws it as a

[4]Your references need not always be to other articles. This example shows you how to properly reference other material:

[5]Doug DeMaw, Technical Editor, *QST*. Letter to the author, dated January 20, 1975.



(a) Before



(b) After

Fig. 1. How to change a diagram by using different symbols, and then combining two smaller diagrams into a larger one.

half-circle with a tiny round dot on the output lead. But *QST* draws it as a square with an "&" sign inside, and a funny looking arrow on the output. Using this new set of digital symbols you could reprint all of *QST*'s 1972 digital articles in 1975 and few readers would be any the wiser.

Rule 4. Butter up the original author. Having decided which article to borrow from, now's the time to apply a little psychology. Some day the author of that article may discover your article and feel you have done him in. This is obviously a very childish attitude, since he should realize that imitation is the sincerest form of flattery, and he should be happy that you have chosen his work to copy. Nevertheless, you have to go out of your way to prepare him for that shock. So take the initiative – write him a real nice letter, telling him how much you enjoyed his article. Make him feel really good, which will make up for the fact that later he will feel really bad. Some gooey phrases like, "The articles show real creative thinking and planning. They are very complete and very well written," would be very appropriate.[6]

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[6]Arlo R. Eggensperger W2TJZ. Letter to the author, dated July 3, 1973.

Rule 5. Camouflage all the diagrams. Having taken care of all the preliminaries, we start by preparing the diagrams. This process involves several steps. Make sure you do them carefully, as they are crucial to your success. If any of these steps seems unclear to you, by all means dig out those old copies of *QST* and *73 Magazine* referred to earlier, and see how the process is done.

Step 1. Redraw the block diagram, if there is one in the original article. (Don't bother drawing a new one if the original article didn't have it, as it is obviously not necessary.) You must be very careful here so as not to change things so much that you ruin them. As a general rule, changing the inputs or outputs a bit should be safe. Different symbols for grounds, coax connectors, or switches will help, too. You can add a new box or two, or split up an old block on the diagram into two blocks. Change some numbers, and maybe even put in a mistake or two, like wiring a switch backward. Presto, change-o: You have a new block diagram.

Step 2. Change all the old digital logic symbols into the new ones. Since the new logic symbols are much more confusing than the old ones, this alone is a major step in camouflage. Don't bother changing anything small – look at the overall diagram and only change those things which are readily noticeable. For instance, changing the pin numbers on a small diagram is a waste of time.

On the other hand, it pays to change a few component values and perhaps transistor numbers. For example, if an original circuit uses a 33 pF capacitor in a certain place, feel free to change that to 75 pF. Just to cover yourself (in case the new value doesn't work), put in a note that says SEE TEXT, and in the text explain (in small print) that if the new values don't work out, the reader should feel free to change them.

As a second example, suppose the original author used a lot of 2N5172 transistors in his circuit. Chances are that he did so because he had a junkbox full of them, not because they were the only ones that would work. You shouldn't use the same transistor because it will look suspicious. Instead, look into your own junkbox to see what your favorite transistor is, and use that.

Step 3. Combine several small diagrams into a larger one. This is an excellent technique, because it changes the appearance of things so much that only the most determined reader or editor will ever spot the similarity. Fig. 1 is a beautiful example of the Before and After diagrams when we apply these successful techniques.

Fig. 1, by the way, shows one pitfall you should stay away from; it applies specifically to fairly complicated drawings. This circuit has ten two-input gates, contained in three different SN7400 ICs. All of these gates are exactly the same and therefore interchangeable; in the same way, the two inputs on any one gate can also be interchanged. This means that there are about 30 billion *different* ways of hooking up these gates in the circuit shown. Thus if you were really starting from scratch, the chances are 30 billion or so against you that you would happen to pick exactly the same pin combinations as the original author did. Even if you just change a pin or two here and there, you will avoid all suspicion of having copied the original circuit.

Step 4. Break up a large diagram into several small ones. The trouble with the previous step was that, by combining several small diagrams into a large one, we were reducing the total number of diagrams. But now we make up for that by doing the exact opposite.

In all of these steps, don't worry if there is something in the original article that doesn't seem to make sense to you. Occasionally the original author will include some circuit trick like mixing up IC inputs and outputs in some inexplicable way. It doesn't pay to try to figure out exactly what he is doing. Simply take his word for it that it's a good idea and include it in your diagram as well.

Change all the old digital logic symbols into new ones. Since the new are much more confusing than the old, this alone is a major step in camouflage . . .

Rule 6. Write the new text to go with the new diagrams. From now on it's all downhill. You have the new diagrams, and all you have to do is to describe them in English. What could be simpler than that?

If you can't think of anything original to say, use a trick known as Taking A Step Backward. The great beauty of this technique is that it is so unexpected that everyone, even your closest friends, will be amazed at your brilliance. To Take A Step Backward, you simply find a few good features in the original design and *omit them.*

If you can't think of anything original to say, use a trick known as Taking A Step Backward. It is so unexpected that even your closest friends will be amazed . . .

For instance, suppose the original author used a regulator IC in his power supply. To Take A Step Backward, forget about the IC and use a Zener diode and three or four transistors instead. After all, isn't 5% regulation 50 times better than 0.1% regulation?

Better yet, suppose the original author went to the trouble of designing a printed circuit board for his project, and included it in his article. To Take A Step Backward, don't tell the reader about the board layout, but make him build it the hard way. This Step Backward has several unexpected benefits.

First of all, you would have been in dire danger if you had included the circuit board layout in your article, as it is probably copyrighted as part of the original article, and you don't want to mess with the FBI.

Second, suppose the original article described some fairly complicated project like a frequency counter, and gave a board layout which mounted all the parts on one board. Break up the parts among a dozen or more boards, tell the reader to use a resist pen to draw his own patterns, and call it a "modular approach." Right away you can spend pages and pages telling the reader why a modular approach is such a great technique. If the readers only knew that using all those little boards instead of the original board layout is going to cost them a lot of time, effort, and wire, they would of course feel you had sold them a bill of goods. But with luck they will never find out.

Finally, don't include the layouts for your hand-drawn boards in the article. For one thing, parts of them might possibly look a bit similar to the board layout of the original article. Moreover, the more difficult you make the job for the reader, the more he will admire your work.

Rule 7. Do not give any credit to the original author. There is only one person in the whole world (besides you, of course) who can fully appreciate the true beauty and great design of your article, and that is the author of the original article you borrowed from. DO NOT GIVE HIM ANY CREDIT. I cannot stress this highly enough.

Most men are basically selfish and mean, and the original author is no exception. No matter how slight the resemblance between your article and his, he will immediately suspect you of the most vile and unjustified actions if he ever happens to see your article. This would be especially embarrasing in this case, as your article may resemble his prior article very much. So do not, under any circumstances, do anything which might call his attention to it. Most important, do not list his article among your references, lest some friends of his (if he has any friends) see it and tell him how nice you were to refer to him.

Of course, to be a successful author, you must learn to use all the tricks of the trade, and one of these is to include plenty of references to earlier articles, if only to show the reader you know what's going on. This seems to lead to a contradiction – what articles do you reference if you can't mention the one article you got all your information from? Simple – find three or four older articles which have very little to do with your own work. For example, a few references to some articles on how to make printed circuit boards would be just fine.

Rather than go on and on with more, I will leave the rest to your imagination and inventiveness. You are probably itching to sit down at your typewriter, so why not give it a try?

. . . K2OAW

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Playing With Power on 432

This article describes the construction, operation, and measurement of a breadboard type rf amplifier for 432 MHz, including the complete testing of all components and their parameters, and a second amplifier mounted in a minibox which can be used either as a driver or a modulated final.

Following my usual system, only new transistors are used, so that unless the manufacturers abandon the type early, you will be able to procure them for the next few years. Of course an awful lot can happen in solid state in a small number of years, but at least you're starting off with a good and available device.

Developing enough crystal-controlled rf voltage for use in amplifiers at UHF is always a serious problem. The tripling exciter described elsewhere works perfectly, but like most tripling systems, each stage has less rf output in milliwatts as you multiply up in frequency. Articles in 73 Magazine several years ago described a favorite tube exciter of mine which used doubling and high gain tubes in every stage to get to 432 MHz, increasing power with every multiplication of frequency on the way up, so that the last doubler – from 216 to 432 MHz – had about 5 W of output. Low-cost transistors are not up to that just yet, but wait a few years or so.

The crystal controlled exciter using tripling makes an excellent small size local oscillator, signal source and test unit, but for use in a transmitter I suggest the doubling method exciter.

Adding one amplifier to the last doubler brings the power up to where it lights a No. 48 bulb on 432 MHz. Really dim, but you can see it. From measurements with the do-it-yourself milliwattmeter this is close to 15 mW.

There is space enough in the minibox exciter for that rf amplifier. I might just put one in there a little later on.

Type Of Transistor

There are unfortunately some thousands of different types of transistors, but what saves the day for us is that there exist some manufacturers of good devices who also remember the amateur homebrewer. It also helps that the entire management, engineering, and technician ranks across the country contain large percentages of amateurs. So Bill Ashby, President of KMC Semiconductors, Long Valley, NJ, sells some of his excellent 2N2500 series for $5 with the number H104. This is it for our purpose here. It multiplies as high as 2500 MHz, and I find that in practical circuits as described, a useful gain of 8–10 dB is obtained. The circuit and construction shown using these transistors can easily accommodate other devices.

Do-It-Yourself Milliwattmeter For Rf

Believe me, when you're working on low-cost battery portable UHF rigs, this item is something you really need. You lads who work in the industry, with an rf power meter on every bench for every technician, think it's easy, but what about when you're in your own shack, tuning up a battery rig for 432 MHz? Then what will you do? You've got some rf – it moves a meter attached to a diode – but how many Watts? Of course it won't be Watts, it will be milliwatts, unless you invest in plenty of dollars for high power devices, so you suffer. Cheer up, here's how not to suffer: For the price of a few No. 48 light bulbs, a 100Ω pot, and less than half a day's work, you can measure from 15 to 180 mW of rf power. And nothing stops you from making a few more, with different scales up into the 5 W range, using the same circuit but a different bulb. A glance at a light bulb chart will show you all kinds of Watts available. So, enough of the sales pitch, here comes the circuit in Fig. 1.

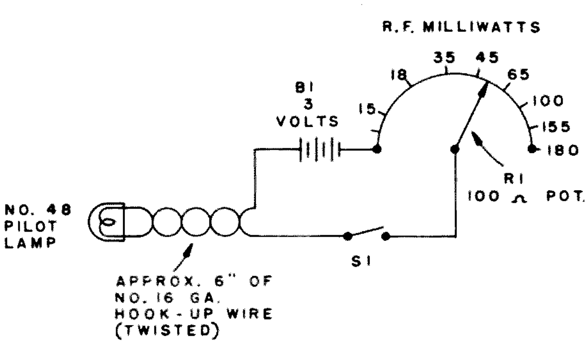

Fig. 1. Rf milliwattmeter

Simple enough, and you just can't make a mistake here – after all, it's dc! Hardly any explanation is needed until you come to calibrate the dial, and even then you just connect a dc voltmeter across the bulb and put a 0 to 100 mA meter in series and adjust the current times voltage to convenient round numbers in milliwatts, like 15, 20, 30, 50, 100, 150 or as many points as you wish.

To operate the milliwattmeter, position bulb A, which is lit by dc, close to bulb B which is attached to L1 as in Figs. 4(a) and 4(b), turn the 100Ω pot until the dc bulb A matches the brilliance of the rf bulb B, as in Fig. 1, and read milliwatts from the calibrated dial. You cannot have *less* than the dc rating, although you may have a little more rf power. It is particularly useful in checking gains of rf amplifiers at these frequencies. This gain, by the way, is not the easiest thing in the world to come by.

The Breadboard Amplifier

This is a real experimenter's unit, spread out so you can change and test almost anything pertaining to a transistor power amplifier on 432 MHz. I feel a little guilty at times using the word "power" when we're beginning with just a few milliwatts, but you have to tell it like it is.

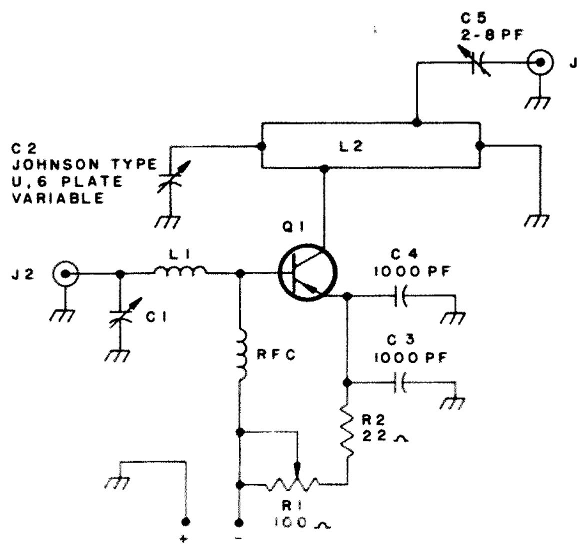

Fig. 2. 432 rf power amplifier breadboard. J1, ceramic phono jack; C1, mica compression trimmer, Arco 400; L1, 3½ turns No. 18 bare tinned copper, 3/8 in. long, ¼ in. OD; RFC, 50 turns No. 40 enamel (surplus choke, not critical); R2, 22Ω 10th Watt; Q1, KMC, H104. L2, see Fig. 3; J2, ceramic phono jack.

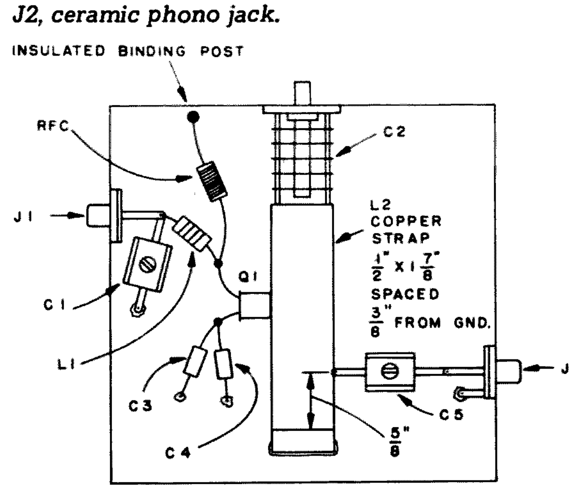

Fig. 3. Breadboard amplifier layout. Q1 case is the collector. Solder to L2.

After all, if you put our three main considerations together – low cost, 432 MHz, and solid state – you will find that it means low power. And don't forget, you can always add, later. So keep this breadboard around for testing that big device, if and when you get it.

Figure 2 shows the schematic, and Figure 3 the layout. The input jack at the moment is the ceramic phono type, and it works. A base input inductance LI is used with CI for matching, and they do a pretty good job as evidenced by testing with different lengths of cables from the preceding unit, which is the doubler method exciter ending up on 432 MHz. An rfc is used from the base to the dc ground, which in this case is the negative battery lead. No external bias was found to be needed for this base, as the rf drive from the exciter pushes Q1 up to some 10 mA collector current. The emitter was bypassed by two small ceramic capacitors C3 and C4.

The emitter resistor needs quite a bit of attention, as usual. Some transistor power circuits use things like 1/10th of an Ohm, so you see what I mean. I started out with a 100Ω pot, with a safety unit of 22Ω in series, and then got down into the less than 25Ω range later when testing the unit as a final amplifier, with a lot more drive and 25 mils of collector current. It does need some resistance, which is also a safety matter. At present I have a 10Ω pot in there as R1, but may change this after modulation tests. Remember that when modulating you need a 24 V transistor if your supply is 12 V. We're specializing on 12 V on the theory that the 12 V car battery will figure importantly in your operation, both mobile and from those hills.

You may or may not be able to light a bulb with rf from LI. If you can't, use a driver like the next unit, the minibox amplifier, which is another name for the first amplifier if you have just two, and then the final will be beyond 50 mW or more, making things easier to start with for tuneup.

After tuning everything up to a maximum I was able to obtain a cherry red glow from just one amplifier after the exciter. This turned out to be close to 15 mW. Figure 4 shows how to match a No. 48 bulb into L1 at 432 MHz. C1 is a copper tab ¼ x 3/8 in., soldered with a 1/8 in. lead to the bulb. The tip of the bulb is soldered to the side of L1, as in Fig. 4(b). Believe it or not, this really loads Q1. C1 is probably of the order of .1 or .2 pF, but that is what it takes at 432 MHz.

When the amplifier is used as the final – that is, driven by the breadboard for one example, or by another similar amplifier, which brings the original doubler output up to a just-visible 15 mW – the bulb lights very brightly and you can relax and really tune things up, check cables, start feeding beams, etc. Every time I say tune things up I don't just mean turning capacitor screws. I mean maybe trying different ones, trying different straps, different connections – in fact, really working with everything there.

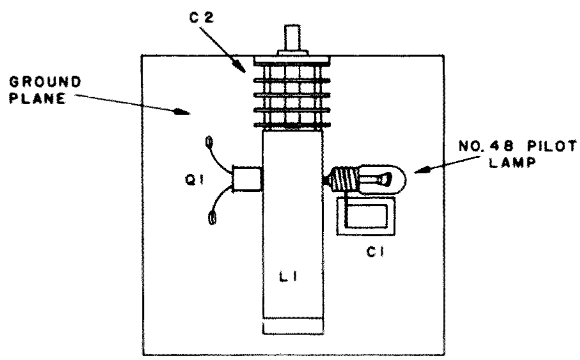

Fig. 4(a). Rf bulb details.

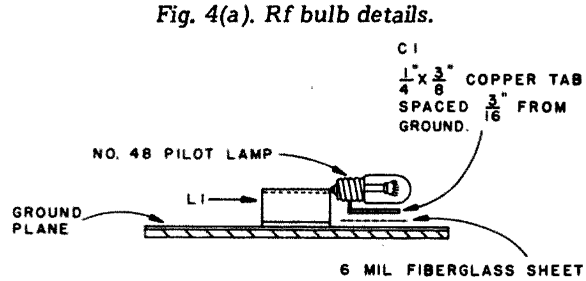

Fig. 4(b). Rf bulb details.

You can also use the rf voltmeter method with the tuned diode to peak things up first. It's just that I like to *see* that rf lighting up something.

So, by now, your rf final should be working away at a gain of 8–10 dB, and you can begin to think about getting on the air.

Minibox Rf Amplifier For 432 MHz

There is a little aluminum box size that is just right for the 432 MHz amplifier. Breadboards are an absolute necessity for checking out components, methods, and circuits, but for assembly into a rig for carrying around, you need a box.

The one I have in mind is 2 in. wide by 4 in. long by 1¾ in., and the amplifier strapline and the Johnson type M variable fit nicely inside. Getting right into details, Fig. 5(a) shows the schematic and Fig. 5(b) the layout.

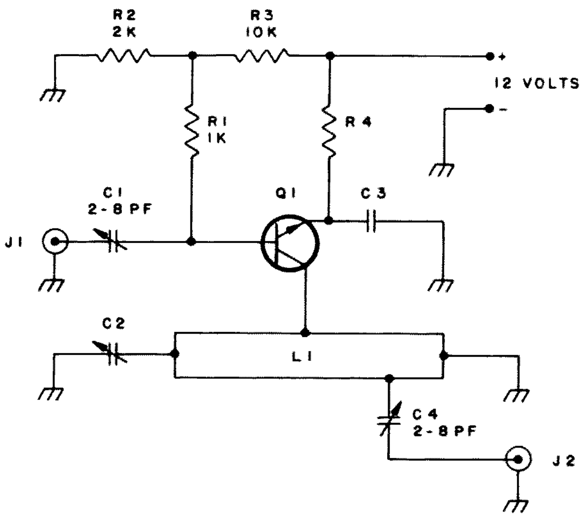

Fig. 5(a). Minibox amplifier schematic. C2, Johnson type M, 160–104, 9 plates total; C3, brass plate capacitor, ¾ x ¾ flat brass bolted to ground with nylon bolts, 6 mil fiberglass insulation; L1, brass strap, or copper, ½ in. wide, 2¾ in. long, spaced ¼ in. from ground. J1, J2 – ceramic phono jacks; R4, 22 Ohms.

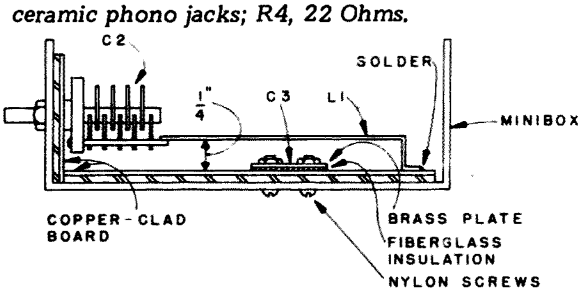

Fig. 5(b). Minibox amplifier detail.

What could be simpler? Actually it will work right away, providing you pay attention to certain basics as listed next.

A. Use a good copper-clad ground plane inside the box.

B. Make L1 as shown.

C. Connect C2 properly to L1, use a vertical continuation of the ground plane, and solder on an extra ground connection for good luck. See Fig. 5(b).

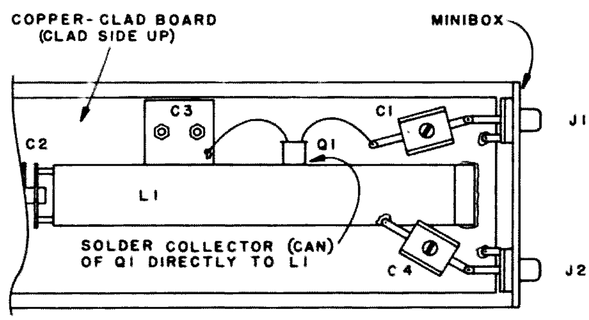

Fig. 5(c). Minibox amplifier detail. Q1 is close to the middle of L1.

D. J1 and J2 need large ground straps for the outer connections. The inner cable connections must go directly to C1 and C4. *No* leads at all! See Fig. 5(c).

E. Solder the transistor case, which is also the collector of Q1, directly to L1. Use a small iron, small solder, and small time.

F. Use a good brass plate capacitor for C3.

G. Solder the base resistor R1 close to the base terminal, or wire, so that no more than 1/8 in. of resistor wire is left.

H. Work on the emitter resistor value of R4. A good rule is to start with a 100Ω pot, put a limiting resistor of at least 22Ω in series, and you will soon get the hang of it.

You can use either the breadboard or this one for the first amplifier. It just happens that I used this one, the minibox, as the first stage. Of course I'll have to build a second minibox one in order to assemble the whole affair into a workable and portable rig, but that's coming.

If everything is made right, you will find C1 and C4 going to jacks J1 and J2 very useful for matching and getting power into and out of this amplifier. Some people prefer an inductance in the input, as in the breadboard amplifier, Fig. 2. Both methods are shown here; it's your choice. They both work well.

Note that some dc bias is used on the base of this amplifier. This is one reason for using it as the first stage, because the exciter may not furnish enough drive to

generate all the bias Q1 may need in order to be fully turned on.

As usual, things happened. In Fig. 5, C4 couples the power out of the first amplifier into the second one. This is a mica compression trimmer, and several times while tuning up I noticed a tremendous jump in current in amplifier No. 2, but assumed it was self-oscillation. Never again! C4 was shorting, which applied 12 V positive to the base of Q1 of Fig. 5. Two 2N2500's, also numbered KMC type H104, bit the dust on that one! I took the trimmer out, and by looking closely in a good light, found half of the mica missing. Live and learn, they say. If only you could earn – instead of spend – on those bloopers, life would be a little easier.

What You Can Work With 100 mW

Just to mention a few things that can be done with battery rigs, checking back down through the years I find the following: In Bermuda, operating Be-BER, on 80.5 meters, I always kept a 201A tube oscillator with B batteries ready as a standby and worked CW all up and down the East coast, New York being some 660 miles away.

Down East on the island in Penobscot Bay, Maine, 8 miles south of Belfast, in the 1930's, again with B batteries – this time on 160 meters which was a wonderful band in those days – I worked everybody around . . . Rockland, Belfast, Deer Island, Castine, etc., and also one fine morning, 1ZE on Cape Cod, all on phone.

In the 1960's with almost exactly 100 mW output on 6 meters and a plain dipole, on Mt. Monadnock in NH, three stations in and around Hartford, Connecticut, were worked. That's a good two hours drive in a car, even today.

Conclusion

There is no need to worry about whether or not you can build rigs at 432 MHz at low cost. The Motorola HEP56 for $1 and change will do everything you want up to 432 MHz. To get a little power there you need to go up a little in price, such as a KMC H104 at $5. That one is also good for 1296 MHz, however.

. . . K1CLL

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More Fun with the IC-230

Owners of the IC-230 seem to be very pleased with its operation. The ease of channel selection and switchable repeater offset certainly contribute to its popularity. However, a very simple modification will make it even more convenient to use.

The present method of selecting the positive or negative 600 kHz transmitter offset is a switch, S5, on the top panel of the transceiver. If the switch is placed in the "A" position, the transmitter frequency is shifted 600 kHz lower than the receiver frequency. The "B" position raises the transmitter frequency 600 kHz above the receiver frequency.

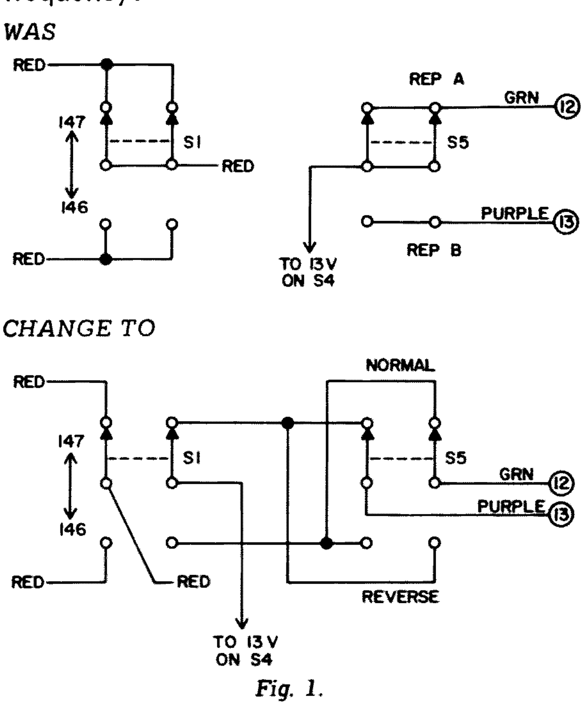

Fig. 1.

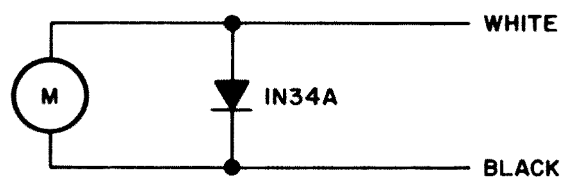

Fig. 2.

Another switch, S1, on the front panel, selects the 146 MHz or 147 MHz band. To properly switch from a repeater in the 146 MHz range to a repeater in the 147 MHz range, the operator must actuate both S5 and S1. An easy modification, shown in Fig. 1, will allow single switch operation. S5 is now wired for "Normal" and "Reverse" and, in the "Normal" position, the correct repeater offset will be automatically selected by S1. Reverse operation is still provided for by placing S5 in the "Reverse" position.

After using the IC-230 for a short time, it was noticed that the meter needle would bang hard against the stop every time a strong signal came on. To prevent this, a 1N34A germanium diode was shunted across the meter, as in Fig. 2. The result is a logarithmic compression of the high end of the meter. Local repeaters now indicate about 9 on the meter scale.

The accessory socket is a convenient place to attach a tone burst generator. Fig. 3 is a diagram of a simple unijunction circuit which provides the 0.5 second tone. The 25k pot is adjusted for the desired frequency with the 2N1595 disconnected.

Fig. 4 shows a novel audio amplifier which will raise the 1-2 Watt transceiver

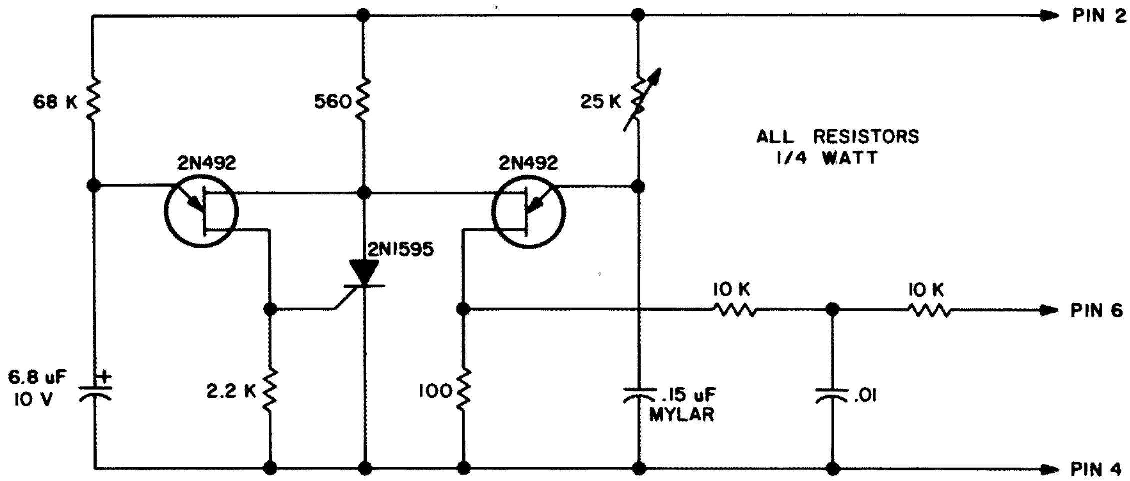

Fig. 3. Tone burst generator.

audio output to the 10-15 Watt range. An 8 Ohm speaker may be used but maximum audio output will only be achieved with a 4 Ohm speaker.

The IC-230 has provision for use on frequencies other than the 30 kHz standard steps. One additional crystal may be used with the CO oscillator and four crystals may be plugged into the LO oscillator. Some areas of the country have repeaters on the

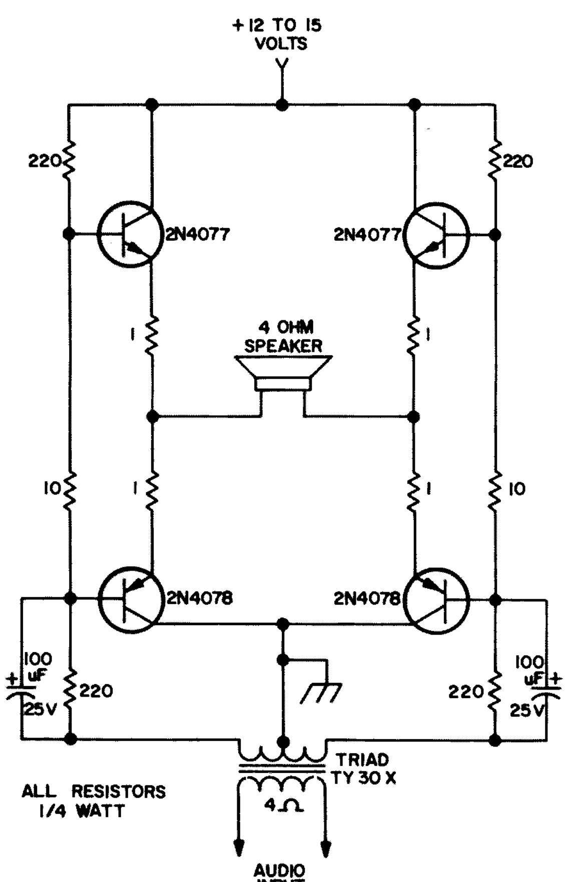

Fig. 4.

split frequencies between the standard channels and it seems likely that, as 2 meter activity increases, this trend will continue. It was therefore decided to get as many of these split channels as possible with the 5 added crystals.

If the following crystals are placed in the crystal holders indicated,

Frequency	Location
11.566 MHz	CO Socket C
13.821 MHz	LO Socket 8
13.858 MHz	LO Socket 9
13.894 MHz	LO Socket 10
13.931 MHz	LO Socket 11

then the following new channels result:

146 MHz Range

Switch Positions	Frequency
A 1	146.355 MHz
A 4	.385
A 7	.415
A 0	.445
A 3	.475
A 6	.505
A 9	.535
A 2	.565
A 5	.595
A 8	.625
A C	.655
B 1	.685
B 4	.715
B 7	.745
B 0	.775
B 3	.805
B 6	.835
B 9	.865
B 2	.895
B 5	.925
B 8	.955
B C	.985

147 MHz Range

Switch Positions	Frequency
A 1	147.015 MHz
A 4	.045
A 7	.075
A 0	.105
A 3	.135
A 6	.165
A 9	.195
A 2	.225
A 5	.255
A 8	.285
A C	.315
B 1	.345
B 4	.375
B 7	.405
B 0	.435
B 3	.465
B 6	.495
B 9	.525
B 2	.555
B 5	.585
B 8	.615
B C	.645

The five added crystals allow simplex operation on all 15 kHz split channels between 146.355 MHz and 147.645 MHz. The positive or negative 600 kHz offset may be selected as described before for repeater operation. . . . WA6VJR

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Does Ether Cause Gravity?

One of the most interesting results of the Palomar telescope has been its ability to reveal large clouds of interstellar gas and dust and to resolve individual galaxies. This in turn has shown them to be commonplace and from the numerous perspectives of these the gravitation-accretion evolutionary pattern of the formation of stars and other celestial bodies becomes somewhat evident.[1]

Not as evident is the carrier mechanism by which light and radio waves are transmitted with high efficiency through vast distances, even with frequencies as low as 30 Hertz from Pulsars.[2] Such a medium has been the subject of thought for years and tentatively named Ether or Aether.[3,6] It is thought to be field-like, has no mass and is thereby incapable of retaining oscillatory electromagnetic energy as heat.

Measurement of outerspace void temperature as Ether temperature is complicated by the presence of one or more gas molecules per cubic centimeter, and the problem of isolating the mass of the temperature measuring equipment from cosmic radiation warming.[4] The lack of mass, and hence specific heat capacity, is probably the most logical means of mathematically estimating Ether temperature at 0°K in space or between the closely packed atoms of objects. It could have a type of superconductivity because of that temperature, if not for some other reason.

The transmission of electromagnetic waves might be by a mechanism of such superconductivity and auto- or self-induction. In this case the very small residual from the Ether/Semimaterialistic/Ether traveling wave transition in the $E = Mc^2$ (energy, mass, speed of light) relationship probably appears mostly as harmonic and other forms of radiation.

Alternately, or in combination, is the conception of Ether being a vast neutral magnetic field, and that magnetism as we generally regard it is a local polarization of Ether. In this event, physical devices such as current carrying wires and permanent magnets are in part probably exhibiting the result of the polarization of the Ether around the parts of their atoms, with the combined field of the atoms and internal Ether equalizing itself by an external return path through the Ether external to the object. With a medium such as Ether as a common interspace property, the generation and transmission of magnetic waves from the transmitting to receiving antennas is more readily understood.

The scope of this phenomenon would seem to include the radiation of very low average power level waves, but probably quantum pulse type, generated by the molecule to molecule chemical chain reaction method employed to pass a signal through a nerve duct. Reception of these waves in corresponding second person ducts

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1 *The Birth of Stars,* Bart J. Bok, Scientific American, Aug., 1972.

2 *Rotation in High Energy Astrophysics,* Franco Pacini and Martin J. Rees, Scientific American, Feb., 1973.

3 *Encyclopedia Britannica.*

4 *Deuterium in the Universe,* Jay M. Pasachoff and William A. Fowler, Scientific American, May, 1974.

inherently incorporates the advantages of extreme sensitivity and wave shape, pulse code or frequency selectivity, each molecule in the nerve channel being a natural delicately balanced equivalent of a regenerative filter. Besides ESP between fauna, such transmission apparently includes flora, as in the Backster Effect.[5]

The Gravity Premise

Ether uniformly permeates space and the Earth, as well as a dust particle or atom, with the exceptions of the actual space occupied by parts of the atom. These exceptions would cause a minute, but accumulatively significant anomaly in the Ether field, the strain being very nearly proportional to the mass of the object. If it is visualized that each object involves such a symmetrical, possibly internally polarized anomaly, and that these anomalies tend to coalesce, the conditions of the well known gravity force equation are approximated:

$$F = G \frac{M1 \times M2}{d^2},$$

where G is the gravitational constant, M the mass of each body, and d the distance between the bodies.

As to these anomalies being a condition of deficiency by exclusion of bits of Ether field by displacement by the parts of the atoms, or one of enhancement due to the parts possibly having derived from Ether and being bits of highly concentrated Ether, would seem to provide an area of exploration and possibly assist in the further identification of the source of matter. Involvement of each object by an Ether strain anomaly in the broad sense would seem to fit such gravity observations as the fall of Newton's apple, the effect of the moon on tides on the opposite side of the earth, as well as outerspace relationships concerning the accretion of dust and gases with increasing gravity, density, temperature and solar activity.

There appears to be no difference in the weight or mass of a magnet bar magnetized or unmagnetized. Even when magnetized, the infinitesimal size of the magnet as compared to the earth or its magnetic field causes essentially equal exposure of its two poles to the earth and cancellation of any attraction-weight effect. Where the size of so-called "non-magnetic" material pieces are smaller than the magnet, some fine differences have been found and utilized for ore concentration purposes.

The relative size effect is perhaps best illustrated by two magnets and their mutual attraction or repulsion, since their poles are distinct to each other and can considerably modify the mutual gravitation force equation when brought into proximity.

While light and radio waves probably involve an extremely small loss in the Ether/Semimaterialistic/Ether traveling transition and accordingly dissipate with distance on this account, gravity in the form of a constant Ether strain would, because of its very gradual accumulation, be stabilized and proceed with its body as an entity in the aspects of relativity.

Summary

Many of the remaining subatomic identities are yielding to predictive analysis based on the equations of relativity, including new versions of an Ether such as that of Dirac, as well as explanation of the Michelson and Morley experiment.[6] While Ether would appear to be the zero energy condition in the absence of mass in Einstein's equation, $E = M c^2$, the dynamic energy of the passage of electromagnetic waves through it, or the static strain of gravity, represent very small excursions of Ether above the zero level. The energy input required to go on to the materialization of stable atomic structure is extremely more than these modest levels, requiring the accumulations evident in the sun and other stellar bodies.

Additional Reference

To Know What We Are, Fred C. Bond, Exposition Press, 1972.

. . . W6NLB/7

[5] *Evidence of a Primary Perception in Plant Life,* Cleve Backster, International Journal of Parapsychology, 10:4, Winter, 1968.

[6] *The New Age in Physics,* Sir Harrie Massey, 1968.

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The Violet Tester

Even though you build and design complex pieces of electronic equipment that shock others in the world of electronics, the average XYL generally has no idea what you have created. She usually thinks in terms of dollars spent, and time you have expended hiding in the basement, building a "Magic Box." Yet, even though not understanding what you have done, she always seems to come up with ego building statements such as "Isn't that wonderful!" etc. Isn't it therefore about time that we create a device that the XYL can understand, is useful, and costs only a *few* dollars? This certainly would provide you with the true recognition you so desire – that of an electronic super genius.

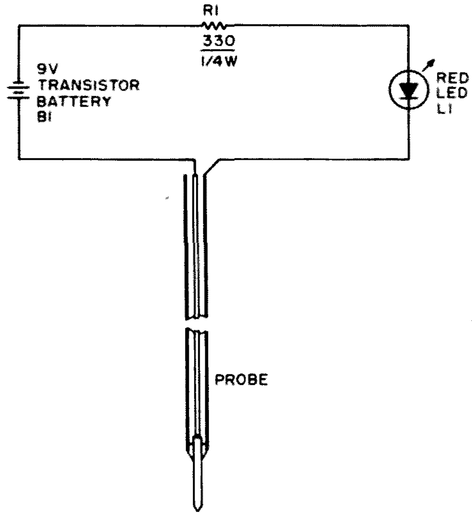

Fig. 1. Violet tester schematic.

The device we are about to describe might be classified as a "one evening kit" and does just as the title says - it tests violets. (Violets are those little plants that grow in the living room window with fuzzy leaves and purple blossoms.) Not only does it test violets, but other miscellaneous house plants as well. This gadget detects the presence (or absence) of moisture and informs the XYL when it is time to water her plants.

The violet tester does not require exotic memory ICs, clock chips or printed circuit boards. One LED (garden variety), a single 330 Ohm resistor and a 9 volt transistor radio battery are all the parts needed for the "heart" of the device. The testing probe, case, etc., may be constructed of miscellaneous junk that you have accumulated.

If you will notice Fig. 1, the 9 volt transistor radio battery is in series with the 330 Ohm resistor and LED indicator. The 330 Ohm resistor limits the current to the LED. Without the current limiting resistor, the LED would draw excess current and soon destroy itself. Also in series with the above are test probes. These probes, when inserted in the soil, will provide a current flow or complete the series circuit if moisture is present. The amount of moisture and mineral content of the soil will determine the current available to light the LED. Therefore, when adequate moisture is present, the LED will come up to near full

brilliance. Varying lesser degrees of illumination will indicate less moisture.

At this point may we indicate that the "violet tester" is not a laboratory standard – it is merely a gadget to indicate relative moisture, and at that, serves its function well. What we are trying to say is – if some plant suddenly shrivels up, it is not the fault of the violet tester. On the other hand, if the vegetation involved suddenly tries to molest you some evening due to its fantastic state of health, it also is not the fault of the tester.

Anyway the device has proved to be much more sensitive than we had expected prior to construction. Common LEDs seem to be very responsive to minute current changes.

The moisture probe does not have to be a single chunk of copper tubing such as we have used. A pair of separate probes spaced 1" will work equally as well. The only requirement is that they be rigid enough to penetrate the soil.

Fig. 2 illustrates construction of the violet tester. We used a small chunk of 1-7/8" plastic water pipe to enclose the main circuitry. The top and bottom plates are made from scrap 1/8" plastic. The top section (containing the LED) is cemented in place with epoxy. The bottom plate is held in place with 4-40 bolts. This allows the bottom to be removed for battery replacement. The 3/16" copper tubing probe must be made secure in the bottom plastic plate as it will take quite a bit of stress when being inserted in the soil. A hole is drilled at the center of the plastic bottom plate just a bit larger than the 3/16" copper tube. A washer is then soldered about ½" down on the tubing. After inserting the tubing through the hole, the washer will limit its travel. Split the tubing that protrudes through the hole with a hacksaw and fold down the halves flush with the bottom plate. Epoxy cement the "fold overs" to the plastic bottom. The washer acts as the stress point.

Grind a piece of #14 copper wire to a point and then solder a good length of insulated hookup wire to the non-pointed end. This assembly is then epoxied inside the 3/16" tubing. A small piece of masking tape wrapped around the center probe will hold it

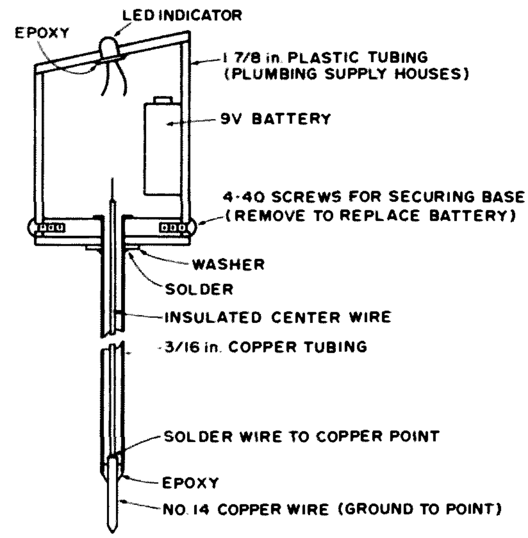

Fig. 2. Violet tester basic construction.

in place while the epoxy dries.

The LED indicator is also held in place in the upper plate with epoxy glue. After the glue has set, the wiring is completed. Use a battery clip for easy replacement of the 9 V battery when necessary.

Just about everything in this device is non-critical yet good results may be expected. The layout and case may be just about anything that is convenient.

Not only may the "violet tester" be used for plants, but it should serve well as a lawn, rose bush, or garden tester. By attaching clip leads and a remote probe, it would tell you when your basement is flooding. It makes a good continuity tester also. Just think – if some clever individuals were to mass produce this gadget, it would probably sell for $5.99 at local discount stores. Therefore, before this happens, you can be the "first on your block" with a "violet tester."

After completing this "one evening kit" you might really have fun with the XYL by telling her it is a tester for the presence of coffee in a cup. If the tester is inserted in a cup of coffee it will indicate with full brilliance. With that, she will know for certain that you are completely "off your rocker" and really do need complete rest for six months in the Bahamas.

We wish to thank our XYL Marie for typing this article and for "proof testing" the violet tester.

. . . W2AOO

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The TT-63A Regenerative Repeater

Some time ago, after becoming interested in amateur radio Teletype, I became the owner of a TT-63A, which I wanted to use as a Teletype converter. After much letter writing and digging through stacks of technical manuals, I came up with the following information.

Basically, the TT-63A is a Regenerative Teletypewriter Repeater used with Teletype Repeater Set AN/FGC-7A. It is capable of accepting RTTY signals in audio (On-Off) or Direct Current (Polar-Neutral) form having up to 45% bias distortion and regenerating the signal to have less than 5% bias distortion at the output. The input keying tone range is 500 to 3600 Hertz per second at 30 milliamps for Polar and 60 milliamps for Neutral keying output. The dc keying must be negative with respect to ground on Mark, and the tone keying may be either normal or inverse. The unit has its own built-in power supply for the voltage necessary for the operation of the repeater unit itself, and requires either 105-125 V ac or 210-230 V ac at 50-60 Hertz. On 115 V ac, the unit draws about 85 Watts of current. The TT-63A is intended to perform two general functions. The first is to regenerate single-channel RTTY signals before operation of a printer. The second is to regenerate diplex RTTY signals to single channel form for the operation of the printer.

Some of the characteristics of the TT-63A are as follows: (1) If there is a missing start pulse due to fading on the signal, the repeater will be started by a following pulse of approximately 10 milliseconds, and will print errors for a few characters until it has corrected itself; (2) If the start pulse is too short in duration (less than 10 milliseconds) at 60 wpm operation, it is treated as noise and intercepted so that a following pulse of longer duration than the 10 millisecond start pulse will act as the start pulse. Again, the errors will be printed for a few characters until the unit has corrected itself; (3) If there is a missing intelligence pulse or if there is a split or knockout of the intelligence pulse at the point where sampling occurs, an error will be printed.

To put the TT-63A into operation, a power supply capable of operating the keying mechanism (Local Loop Supply) of the Teletypewriters must be connected in series with the output of the repeater. It is recommended that shielded two-conductor cable be used for the line connections, to reduce random noise to a minimum. For neutral or polar dc inputs, the side of the line connected to the negative terminal board connector must be negative during the Mark signal. The positive neutral input connection to the repeater is ground. The positive Polar input connection is 620 Ohms to ground as is the negative Polar terminal.

This provides for polar inputs that are balanced in respect to ground. The tone input to the repeater is normally 600 Ohms balanced to ground, but by grounding one of the tone input terminals, an unbalanced tone input may be used.

To operate the unit, allow fifteen minutes for warm-up after the repeater is turned on. Inside the access door on the front panel make the following settings of the controls:

Turn the Normal-Reverse switch to the Reverse position. The neon lamp should go off. Return the switch to the Normal position and the neon lamp should be lit again. This check shows that the repeater is powered and that the Trigger circuit is operating. Next, set the Speed switch to the range desired for the operating speed of the Teletype equipment. The next step is to set the switches inside the access door to coincide with the input fed to the TT-63A. The Tone-Dc switch is set to the "Tone" position if using an audio type of input signal. The Neutral-Tone-Polar-Diplex Tone switch is set to the Neutral-Tone position, and the Normal-Mark-hold switch set to the Normal position for print upon a received signal. In the Mark-hold position the output is a constant MARK signal and in most cases will keep the machine from printing even with an input signal. Next, apply a signal to the repeater. The neon lamp should blink when the signal is applied. If the lamp does not blink, advance the Input Attenuator clockwise until a point is reached where the lamp does blink. This is called the Trigger point. Now advance the Input Attenuator control another six steps (6 dB) beyond the Trigger point. If the attenuator control reaches "0" before six steps can be made, set the control to "0." Set the Range control to "50." The Teletypewriter printer should start printing. If there is some distance between the main printer and the repeater, a monitor page printer can be plugged into the Monitor jack. Finally, slowly rotate the Range control of the repeater from "0" to "100." If the Teletypewriter begins printing errors or garbling at any point within the tuning range of the range control, set the control to halfway between the settings in which the errors began. For example, if

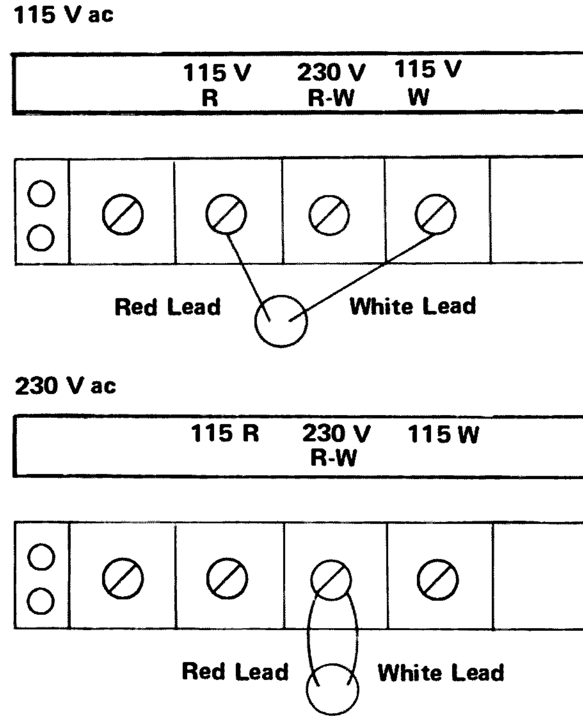

Fig. 1.

while tuning up from "0" the printer started printing garble at 80 on the range control, then set the control at 40. If errors or garbling begins with the control set at "0", check the speed setting on the Speed control inside the access panel.

For operation from 220 V ac, make the following changes on the terminal board on the rear of the repeater chassis. Remove the red lead connected to the 115 V R terminal and connect to the 230 V R-W terminal. Remove the white lead connected to the 115 V W terminal and connect it to the 230 V R-W terminal. The set is now ready to operate on 220 to 230 volts ac. For complete operation and maintenance instructions, a copy of Army Technical Manual TM 11-2247 should be acquired.

These units have been readily available from the surplus houses for as little as fifteen dollars, and manuals may be obtained from Sam Consalve W3IHD. The TT-63A is an inexpensive way to get started on radio Teletype, and when the final converter is acquired or built, the TT-63A can be added to the other converters as a simple linear discriminator with axis restorer ahead of the better converters with very little modification.

. . . WB4APC/DL5KS

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Oscaring Your FM Rig

You can work DX on 2m via Oscar.

Oscar 7 is now in orbit, and Oscar 6 is still going great, too. Both of these satellites have a two meter to ten meter translator flying aboard and it's quite exciting to hear your own signal coming back via the satellite. If you haven't ever listened to the downlink signals, you'll find them between 29.400 MHz and 29.550 MHz (Oscar 6 – 29.450-29.550; Oscar 7 – 29.400-29.500). Copy the broadcasts from W1AW, or write to AMSAT for a schedule so you will know when to listen.

Once you hear the satellites, more than likely you will want to communicate through them. You will need some type of CW or SSB transmitter capable of operating on two meters. You say you don't have a two meter CW/SSB transmitter – well, don't skip to the next magazine article yet! Chances are you have some type of FM rig. With just a slight modification you can put it on CW. My rig is a Standard SR-C826m, ten Watts solid state. Although the specifics in this article are for the 826m, the ideas should be easily adaptable to many of the rigs on the current market.

First, you will need to get a crystal that will put you in the passband of the satellites. The input frequency passband for Oscar 6 is 145.900 MHz to 146.000 MHz. Oscar 7's input runs from 145.850 MHz to 145.950 MHz. As you can see, the passbands overlap by 50 kHz. So, if you get a crystal, say on 145.925 MHz, you could work through both satellites with just one rock. Via Oscar's translator, your downlink frequency would be 29.475 MHz plus or minus Doppler shift (and some conversion error on Oscar 6).

Now that you have selected a frequency and have installed the crystal in the radio, how do you go about keying the rig? The simplest way is keying the PTT lead. However, this has several drawbacks. Number one, you will wear out the relay contacts, especially if you are a high speed CW op. Secondly, your signal will no doubt have a chirp because you will be keying the oscillator on and off. So what is needed is a way to allow the oscillator to run continuously to eliminate the chirp, and a way to key the transmitter without chattering the relay. Here's how I did it with my Standard 826m:

To eliminate relay chatter and chirp, the PTT lead is shorted to ground. This transfers the antenna to the transmitter output and turns on the oscillator. Of course, with no modifications made as yet, the transmitter output is present also. Now to eliminate that except when it is desired, i.e. when the key is down.

Looking at the diagram of the transmitter swr shutdown circuit, note that Q340 is normally biased on by R327. This completes the emitter circuit of Q336, the pre-driver transistor in the transmitter. An excessive

swr develops positive voltage at the base of Q341 which turns Q341 on, in turn clamping the base of Q340 which turns it off and opens the emitter circuit of Q336. Hence, no output. Now, if we control this circuitry with a telegraph key, we will have accomplished our second goal. It can be done two ways, at least.

One way (Mod. 1) is to break the emitter lead of Q340 and key it to ground. Use a bypass from the emitter to ground. A .01 uF will do. Without the bypass, the keying lead acts as a choke and may cause problems. I have modified three rigs this way. Two worked just fine. The third was a bit squirrelly. The output was not as much with the key in the circuit as it was before the modification. So I came up with the second arrangement. Although the first way is the simplest, I prefer the second because it does not modify the rf path of the original circuitry.

The second way (Mod. 2) is to break the lead from R327 to +12 volts. This removes the bias from Q340 and turns it off, thereby cutting off the transmitter. Connect the key between +12 volts and R327. Key down, Q340 turns on and transmitter output returns. It keys clean and there is no problem with rf. Strictly dc keying.

The only modification required to the radio is to cut the paths on the circuit board to isolate either the emitter of Q340 or the high side of R327, depending on which modification you are going to use. Then run a wire from the isolated lead to pin 3 on the RT jack on the back panel of the radio. (Pin 3 is normally unused as it comes from the factory.) If you are keying the emitter of Q340 to ground (Mod. 1), the key goes between pins 1 and 3 of the RT jack, with the PTT shorting jumper between pins 1 and 5. If you are keying +12 volts to R327 (Mod. 2), the key goes between pins 3 and 8 of the RT jack. The PTT jumper is also required (1 to 5). Note: There are +12 volts on pin 8 of the RT jack as long as the radio is connected to the power supply. Turning the On/Vol control switch off does *not* remove this voltage. Use necessary precautions.

I wired two plugs for my radio. One simply has a short across the two pins where

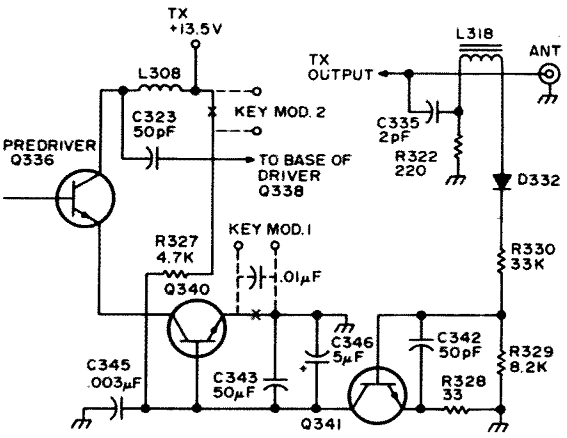


Fig. 1. Swr shutdown circuit. All transistors are NPN.

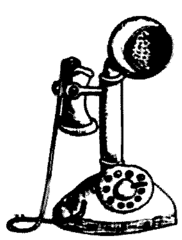
the key is connected. When this plug is installed in the RT jack, the radio is returned to normal FM operation. The other plug has the PTT jumper and the two wires going to the telegraph key. When it is inserted in the RT jack, the relay keys, supplying voltage to the exciter. Press the key and you are on the air. With the ten Watts and a 10 dB gain antenna system, you've got 100 Watts erp of CW ready for Oscar. If you want, you can drive an amplifier with the rig to get a little more punch. (Ten Watts drives the pants off of a pair of 4X150's. 300 Watts output!) By the way, be sure to disconnect your microphone or you'll have keyed FM instead of CW.

I used this system on Oscar 6 and successfully completed hundreds of QSO's – nearly 40 states and four continents including F9, G3, GM3, VP9, 8P6, PJ7, PJ9, KL7, and KH6 – all in just a few months. Floyd W4GSH has used an 826m keyed this way to drive a tripler to 432 MHz and has made many contacts via Oscar 7's 432 MHz to 144 MHz translator.

After you get your initial setup, you will want to build a VXO so you're not rockbound to one frequency. But at least now you know one way to get started. It's not a difficult modification and it doesn't deface the rig in any way.

Satellite communication is one of the newest challenges to the modern amateur. With this simple approach, for the price of a crystal and an hour's labor, you can meet that challenge. Besides, it just might prove to be fun!

. . .WA4VUH



Basic Telephone Systems Part Two

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Inside Ma Bell

In several areas, the telephone companies have recently started to check customers' lines for extra extensions not rented from them. When a phone is on-hook, a series circuit consisting of the ringer and a 0.5 μF capacitor is still connected across the phone line. Using fairly simple equipment, this load can be sensed and measured. When a dc voltage is first connected to a capacitor, a current flows through it until it has a chance to charge up to the applied voltage. For example, if you connect an ohmmeter set to a high Ohms range to a capacitor, the meter will swing up and then slowly drift back down. Some meters (such as the Simpson 260) have a polarity reversal switch, which changes the applied voltage's polarity as you flip the switch. Connect that to a phone, and each time you flip the switch, the 0.5 μF capacitor will charge and cause a momentary swing up of the meter needle. The distance that it swings is an indication of the capacity, or in the case of phones, of the number of telephone bells connected in parallel.

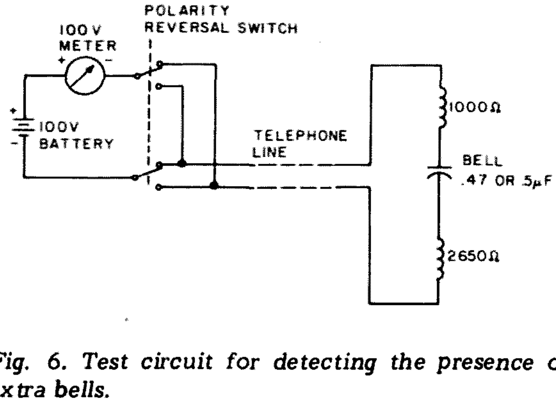

Fig. 6. Test circuit for detecting the presence of extra bells.

It appears that a circuit similar to that of Fig. 6 is actually used by telephone company personnel in checking the line capacitance. Each time the reversal switch is flipped, the voltmeter shows a brief burst of current going into the line to charge the bell capacitor. How high up the meter swings and how long it stays there indicates the capacity. While it may be difficult to get an accurate reading from the CO, since there may be thousands of feet of wire between the telephone and the CO, it is an easy matter to send a telephone installer to the basement of the customer's apartment house, or to climb a pole near the customer's house, if a suspicious reading is obtained.

There are a number of well-known techniques used by people to avoid such problems. The obvious solution is to simply disconnect the ringer in any extra telephones. In cases where an extra bell might be convenient, a circuit such as that on page 31 of the April 1974 issue of 73 Magazine could possibly be used to ring as many conventional bells as one might want. There are people, of course, who take simpler steps. One popular technique is to disconnect all ringers, and instead substitute a relay circuit whose impedance is close to that of the company-installed ringer; the relay can then be used to ring any bells you need. A circuit such as the one in Fig. 7 might work; the total resistance is close to the 3650 Ohms and the capacitance is close to the 0.5 μF actually used, so this circuit should look just like your normal telephone bell. (For \$2.15 per month, the New York Telephone Company will rent you a ringing relay that

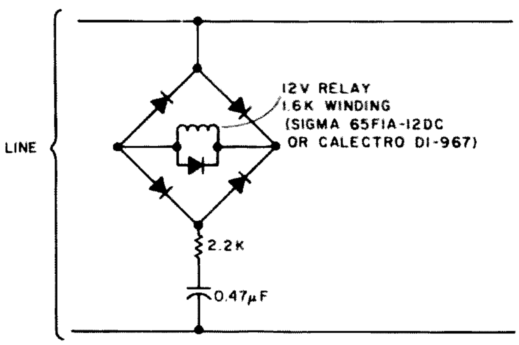

Fig. 7. Substitute bell circuit.

does just this.) I have heard of yet another solution, though it too is against tariffs and hence not recommended. It consists of replacing the 0.5 μF capacitors in each of two phones with 0.25 μF, which makes the bells ring slightly softer than before, but does not change the total capacitance. The series resistance and inductance change, of course, and so this is an intriguing solution but not a technically foolproof one.

There are only two solutions which will satisfy the phone company's desires – either use a "wireless" technique of coupling to the phone – inductively or acoustically – or rent a wired coupler directly from the phone company. Despite the fact that wired couplers are simple and could be built by any one of a thousand little electronics companies, the telephone companies claim that only they are technically advanced enough to build and install them, and so you have no other choice but to pay their exorbitant rates.

I don't know about the tariffs in other states, but the New York Telephone Company tariff (which is filed with the state's Public Service Commission and available for inspection at any telephone company business office as well as many libraries) specifically states that any acoustic or inductive connection to its equipment is OK as long as it is done outside the telephone company equipment, and as long as any signal fed back into the telephone line is below specified levels. These levels are specified in the New York tariff as follows:

> ". . . to prevent excessive noise and cross-talk in the network, it is necessary that the power of the signal at the input to the line not exceed 9 decibels below one milliwatt when averaged over any 3-second interval."

The one exception to the -9 dBm requirement is that if you have a Teletype machine and use acoustic or inductive coupling of the Teletype tones into the line, the company may authorize a level up to 0 dBm at your end of the line as long as the power at the CO does not exceed -12 dBm. (With direct connection using a coupler, the wording is a little different, specifying only that the power of the signal at the central office must not exceed 12 dB below 1 milliwatt over any 3-second interval.) Moreover, the power in the range from 3995 to 4005 Hz must be 18 dB below the maximum level specified above, which is probably designed to protect its long distance services, which use a 4 kHz carrier spacing.

Additional level limits are as follows:

Maximum power in 4 to 10 kHz range is -16 dBm;

Maximum power in 10 to 25 kHz range is -24 dBm;

Maximum power in 25 to 40 kHz range is -36 dBm;

Maximum power in above 40 kHz range is -50 dBm.

Finally, it is not allowed to have any energy solely in the range from 2450 to 2750 Hz, and the total power of any signals in the range from 2450 to 2750 Hz must be less than the power of any signals in the 800 to 2450 Hz range at the same time. The purpose of this prohibition is to avoid interference with a very interesting signalling tone at 2600 Hz. More on this later.

Acoustic couplers are commonly used with computer equipment. Such a coupler consists of a cradle into which the phone handset fits. Under the handset's mike is a speaker, and under the handset's earphone, is a mike. In this way it is possible to get audio into and out of the phone, but of course, it requires somebody human to do the dialing or to answer a ringing phone and put the handset into the cradle. If you have Touchtone service, it is possible to dial acoustically into the phone, but a very high level is needed to achieve reliable dialing, and sometimes it's hard to pump that much energy into the phone's microphone without

getting a lot of distortion. As to answering the phone, you could build some sort of solenoid which would push down and release the hookswitch on the telephone. If the solenoid were fast enough, you might even be able to use it to dial by rapidly pulsing the hookswitch up and down the required number of times. Finally, detecting a ring could be done with the same microphone which picks the audio out of the handset. As you can see, this whole arrangement can become a Rube Goldberg monster of mechanical construction. There is a slightly easier way out of it, and that is to get the cradle which is used with the Crown telephone answering machines. It has the required acoustic coupler; it has a solenoid which can push the hookswitch plunger up and down; and it even has a second mike to sense the telephone ring.

Inductive methods are also allowed. For instance, most electronics stores sell an inductive pickup which can be placed near the handset or near the hybrid network and will pick up enough audio out of the phone. But getting enough audio back into the phone inductively requires a lot of patient work, and I suspect it would be awfully hard.

And that brings us back to the phone company's own couplers. As mentioned before, telephone companies generally require that such a coupler, which they suggestively call a protective coupler to pretty up the idea, must be rented from and installed by them. This is roughly analogous to your local electric company's claim that only they are smart enough to make and install toasters and light bulbs, and that you must rent all your house appliances from them at prices far above and beyond the going rates.

The funny thing is that even though the couplers are such obvious moneymakers in themselves, the phone companies make you feel as though they are doing you a favor when you want one. It's obvious that renting extensions and extra jacks and bells and fancy bedroom phones must be good business, or they wouldn't work so hard to keep the competition from muscling in.

My own experience confirmed what others told me — be prepared to do a lot of

waiting and explaining. Before talking to me, the Business Office wanted to know my whole life history – where I lived, what my phone number was, what I wanted to connect, etc. It's like the gas company asking whether the gas they were selling me was for making coffee or baking a cake. Then they told me they had no information, but a salesman would call me. Their salesmen have unlisted numbers, so it's "don't call us, we'll call you." When they finally call, it's always the wrong fella – no, that's not his specialty, but someone else will call by and by. No, they have no catalogs; no technical literature either. Sorry, but the information is not available. Can't tell you what we have available – you tell us what you need, and we'll quote you a price. Yes, you can get on a mailing list if you call 195 Broadway. Sorry, but information doesn't have the phone numbers for Telephone Company offices; perhaps 330 Madison Avenue can help? At 330 Madison Avenue, the operator doesn't know what you are talking about. Perhaps some big Cheese's secretary can help. How did you get this number, sir – subscribers are not supposed to call this number! Sorry, no technical information is available. Humbug!!! No wonder there are hundreds, perhaps thousands, of phone phreaks around the country whose sole aim in life is to screw the Phone Company.

The first step in getting information on any of these couplers is to visit either your local Business Office or a big branch of the library, and ask to see the telephone company tariffs. Don't be surprised if the Business Office personnel get all flustered when you ask to see the book – you have every right to see it. In my case the receptionist asked whether I was planning to use the tariffs to sue them, while the office manager gave me a pep talk on how the telephone company is being robbed by interconnection companies of the "cream of the business" and is suffering under unfair competition.

While the rates from your own telephone company are undoubtedly different, you may be interested in some of the information we gleaned from our local tariff book.

First, if you go out and buy your own

telephone, you must contact the local telephone company to have them convert and install it. If the telephone housing is stamped as being approved by the company as being compatible with their equipment, then they will tear out the guts and install a ringer and network, a new dial, new microphone and earphone, and some cabling. For this they will charge you $15.64 conversion fee, $13 installation, and $1.35 monthly charge which they get for an extension telephone.

If the housing is not stamped that it is approved, then you get the same service but the installation charge goes to $39.11, unless the housing is such that their parts don't fit into it, in which case they just won't do it. Now, if you buy a Western Electric phone just like the one used by the local phone company, it will probably not be stamped as being approved. That means they tear everything out, put in new parts (or maybe even the same old parts?), and charge you the $39 and change. Plus $1.35 a month. Oh yes, on top of everything else, you still have to pay the $13 charge for having an extension put in.

Unless you have a priceless vase from the Ming Dynasty that you desperately want converted into a phone, it obviously doesn't pay to let the phone company touch it. Even then, whether you'd want them to touch a priceless vase is questionable anyway.

The other way to get a fancy telephone is to order one from the phone company. For a price ranging from $56 to $110 you can order a "Design Line" phone which they will then happily install for $13 and charge you $1.35 for every month. If you don't want a gold-painted phone, a plain black one is just the $13 and a monthly charge. For an extra charge you can get colors, etc.

The gist of all this is that any way you look at it, you can't get away from the basic $13 installation fee and the $1.35 a month, regardless of whether you use your phone or theirs, so you might as well settle for theirs.

On the other hand, there are some fascinating gadgets which might be of interest to you after all. For instance, suppose you want to hook up 10 extension phones in your house. For only $5.35 a month and no installation fee, you can get a CD8 coupler which is designed for privately owned switchboards. Throw together a few relays to make a "switchboard" and you can connect all 10 of your own phones to this one coupler, in accordance with the tariffs, and without having a guilty conscience disturb your sleep. Let's look at a few of the couplers available and what they can and can't do. Our discussion will center on Western Electric couplers available through Bell System telephone companies, but similar units are available from other telephone companies as well. The prices mentioned are those charged by the New York (Bell) Telephone Company, and other telephone companies may charge more or less

The simplest coupler is the 30-type device shown in Fig. 8. As with other couplers, this unit is referred to by its USOC – Uniform Service Ordering Code – which is QKT or QKTBT. These couplers cost $0.72 a month plus an installation fee of $28.94.

As shown in Fig. 8, the coupler consists of just a few parts. The matching trans-

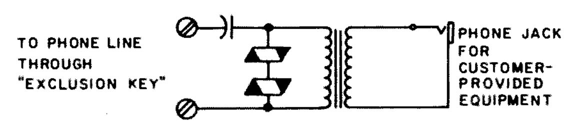

Fig. 8. The simplest protective coupler – the 30-type or F57948(MD). (The 30-type doesn't have the screw terminals.)

former has a 600 Ohm impedance at the phone jack, and can be used both for transmission and for reception. It provides dc isolation from the phone line and also prevents accidental grounding of the line. The two varistors in series limit the maximum audio signal level that can be fed back to the line. Finally, because of the series capacitor, the coupler does not complete the dc circuit through the phone line. It must always be used in combination with a telephone-company-supplied telephone set which is used to place and answer calls, and which completes the dc circuit during the call. To prevent the 20 Hz ringing voltage from being applied to the coupler, the coupler is wired through the associated telephone set so that it is connected to the line only when the telephone set is off-hook and a separate switch called the "exclusion key" is operated. (At your option, you may have the exclusion key wired so that when the coupler is connected, the telephone set

mike and/or earphone is disabled.) Hence, this coupler is for strictly manual use – you have to manually operate the telephone hookswitch and exclusion key. Thus this coupler could be easily used with your phone patch on sideband, but would be useless for a repeater autopatch or automatic answering machine. If you didn't mind the extra work of operating the main telephone set, you could hook up any number of your own extensions as shown in Fig. 9. But these extensions could only be used to talk and listen through – they would not ring, and you could not use their rotary dials nor could you start or end a call from them, since only the telephone-company-supplied phone controls the connection.

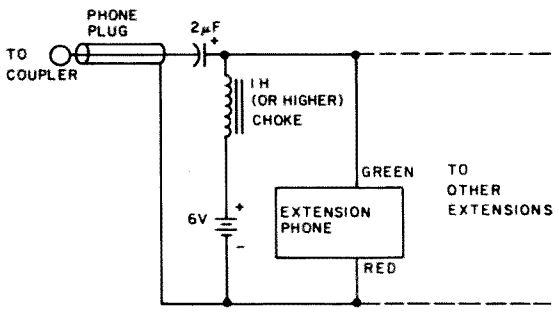

Fig. 9. Connecting extension phones to a 30-type coupler. The 6-volt battery supplies talk current to the extension's carbon microphone only when an extension is off-hook.

If you have Touchtone service, then a Touchtone extension may be used to provide dialing if you get the right coupler. The QKT Voice Connecting Arrangement (which uses a 30A coupler) has varistors which clip at a lower signal level than those of the QKTBT, which uses the 30B coupler. As a result the QKTBT is needed for reliable Touchtone dialing as the QKT may not let through enough signal.

This may be a good place to look at Touchtone dialing requirements. The frequency tolerance of the tones is ±1.5%. Any other frequencies present during dialing (such as harmonics or intermod) should be at least 20 dB below the Touchtone tone power. Any voice signal should be at least 45 dB below. Each of the two tones should rise to at least 90% of full level within 3-5 milliseconds and should not overshoot by more than 12 dB. The minimum tone-on time is 50 milliseconds, the minimum tone-off time between digits is 45 milliseconds, and the maximum dialing speed is 100 milliseconds per digit.

As for Touchtone level, we mentioned earlier that the maximum power allowed into the system with a direct coupler is such that the power measured on your line at the CO does not exceed -12 dBm when averaged over any 3-second interval. To translate this into power *into the coupler* we need to know the loss in the landline between the coupler and the CO. This loss may be anywhere from 0 to 10 dB. The figure usually used by the telephone company as an average is 3 dB. It is fairly easy to measure (if you know how), since there is a number you can call which returns 1000 Hz at 0 dBm (measured at the CO) back to you. Measure the level at your end of the line and you can calculate the loss. In fact, if you get a computer data coupler (rather than a voice coupler) the phone company will measure it for you!

Assuming 3 dB as an average, that means you can feed -9 dBm into the line at your end. Since the coupler loss is about 2 dB, you can then feed -7 dBm *averaged over 3 seconds* into the coupler. But this is only an average power – if you dial with a duty factor of 25% (25% on, 75% off) you can raise your tone-on power by a factor of 4 (which is an extra 6 dB) to -1 dBm while still keeping the average power at -7 dBm.

But of course, you have two tones whose powers add, so each tone should be 3 dB lower. This works out to about -4 dBm for each tone going into the coupler.

The above calculations are for an average case only. To ensure correct detection by the CO, the phone company recommends the following limits into the coupler:
Nominal power for each tone: -4 to -6 dBm;
Minimum low-tone power: -10 dBm;
Minimum high-tone power: -8 dBm;
Maximum two-tone power: +2 dBm;
Maximum difference between the high tone and the low tone: 4 dB.

Anyhow, the QKT coupler will generally limit (or distort) Touchtone tones below a suitable level, and the QKTBT is designed to pass tones at a high enough level.

The CDT coupler is functionally similar to the QKT coupler, but is designed for data

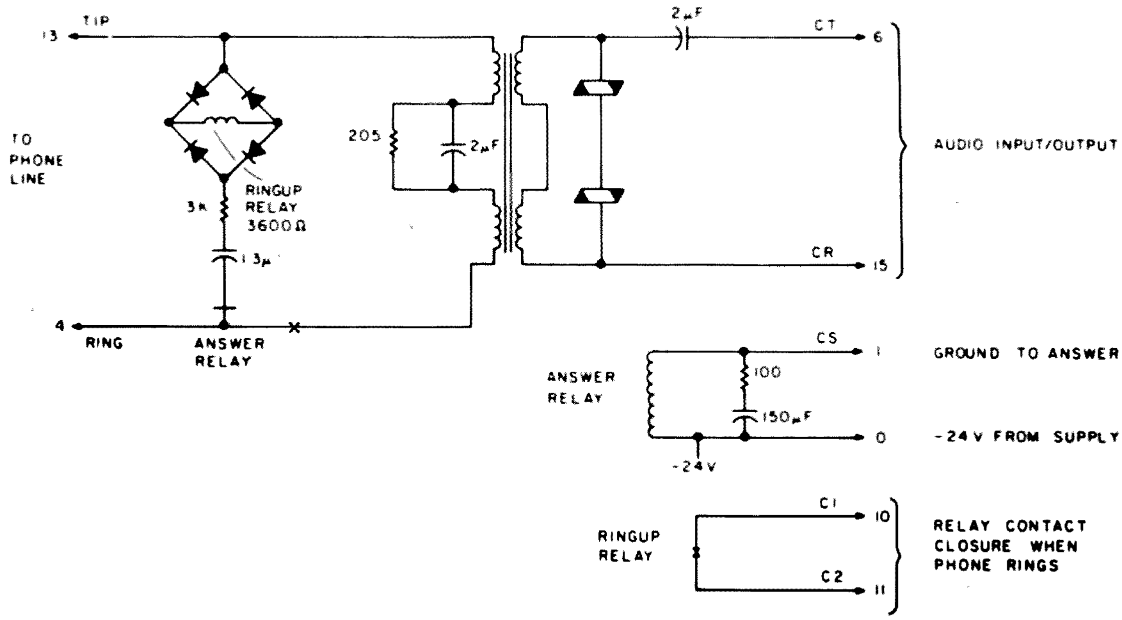

Fig. 10. Simplified diagram of 108A IU (Interconnecting Unit) which is part of the CD6 Voice Connecting Arrangement.

transmission rather than voice transmission, though it can handle voice and Touchtone as well. It differs from the QKT mainly in price ($2.46 a month and $30.74 installation) and in the fact that it has a built in test oscillator which allows the phone company to test it remotely without sending a man out. Here is another example where the phone company charges you extra for a feature whose only purpose is to save the phone company money.

Of more interest are the couplers suitable for automatic operation. For example, there are several couplers designed for connecting a privately-owned switchboard to a telephone line. Fig. 10 shows the insides of a CD6 coupler (which costs $4.86 a month). Fig. 10 is actually a simplified diagram of the 108A circuit board used in the CD6 as well as some others. In addition to the transformer and varistors which are in almost every coupler, there are now two relays and a few other components. This particular coupler is designed for incoming calls only. When an incoming call comes in, the 20 Hz ringing signal is rectified by the bridge rectifier and operates the ring up relay, which closes contacts C1 and C2, which can be used to light a light, sound a bell or in some other way signal the call. To answer the call, you ground the CS terminal which energizes the answer relay. This relay switches the telephone line from the ring up circuit to the transformer, which completes the dc circuit through the coupler so the CO knows that the call has been answered. Once this is done, you can feed audio in and out via the CT and CR leads.

Since this device is designed only for incoming calls, the phone company has to make sure you don't misuse it. Hence the RC network across the answer relay coil is there so you can't pulse it fast enough for dialing. (The varistors are probably chosen so you can't feed enough audio through for Touchtone dialing either.) Even if you could pulse the relay coil fast enough, it might not be fast enough to reproduce the dialing pulses without distorting the 60-40 ratio of off and on.

A somewhat more interesting series of couplers is the CD7, CD8 and CD9 group. They all use the 102 series PC board, which is shown simplified in Fig. 11. This board is designed for both incoming and outgoing calls. (The 102B is a newer version of the 102A shown.)

On an incoming call, the 20 Hz ringing voltage energizes the ring up relay, which gives you a contact closure on the C1 and C2 leads. (As with most of these, this is not a clean closure. Due to the low frequency and the bridge rectifier, the relay is pulled in on every half-cycle of the ringing, and so the

relay contacts pulse at a 40 Hz rate for 2 seconds and then release for 4 seconds, in step with the ringing.)

To answer the call you ground the CS lead, which closes the answer relay K4. This disconnects the ringing bridge from the line and completes the circuit through the transformer. Now you can feed audio in and out via the CT and CR leads, and at the end of the call you release the CS lead from ground.

For an outgoing call you start by grounding the CS lead, which closes K4, completes the dc circuit across the line and allows you to hear the resulting dial tone on the CT and CR leads.

Dial pulses are generated by momentarily opening the CS lead, which pulses the K4 relay. But this also operates the delay relay K5, which pulls in and doesn't release until a short time after the last pulse. K5 substitutes a resistor dc load across the line instead of the transformer; this prevents the dialing clicks from appearing on the CT and CR leads. Touchtone dialing through the coupler is also possible. K2 and K3 provide an interesting additional feature. As mentioned earlier, normally the tip is positive and the ring negative. But it is possible to order a service called toll diversion or toll denial, where the CO automatically reverses the polarity on your line during long distance calls. (In some CO's this feature may exist on a line without having to be ordered.) If this happens, K2 closes, which in turn operates K3 and closes the relay contact between the CRV1 and CRV2 leads. This can be used by the customer's switchboard to automatically prevent long distance calls from being made.

Since the same PC board is used in a variety of couplers, how do they differ? Here's the summary:

The CD7 ($5.35 a month and no installation charge) has all of the circuitry in Fig. 11, but the C1, C2, CRV1 and CRV2 leads are not brought out to the "customer's side" of the connection block. You need a ¼" piece of wire to bring the lead from the telephone company side to the "customer's side." In other words, the CD7 is supposed to be used only for outgoing calls without toll diversion.

The CD8 (also $5.35 a month) has the CRV1 and CRV2 jumpers but not the C1 and C2 jumpers. Here the 2 jumpers are free, right?

But if you want the 2 jumpers on the C1 and C2 leads, that makes it the CD9, at $7.99 a month. This time the two lousy pieces of wire cost you an extra $2.64 a month. I wonder how many million percent profit that makes – each month.

The 102-series board is also used in several other couplers. For example, a CET coupler is just like the CD7 but connected directly to a long distance operator rather than to a CO dial line. The C2ACP ($7.42 a month and $29.43 installation) is just like

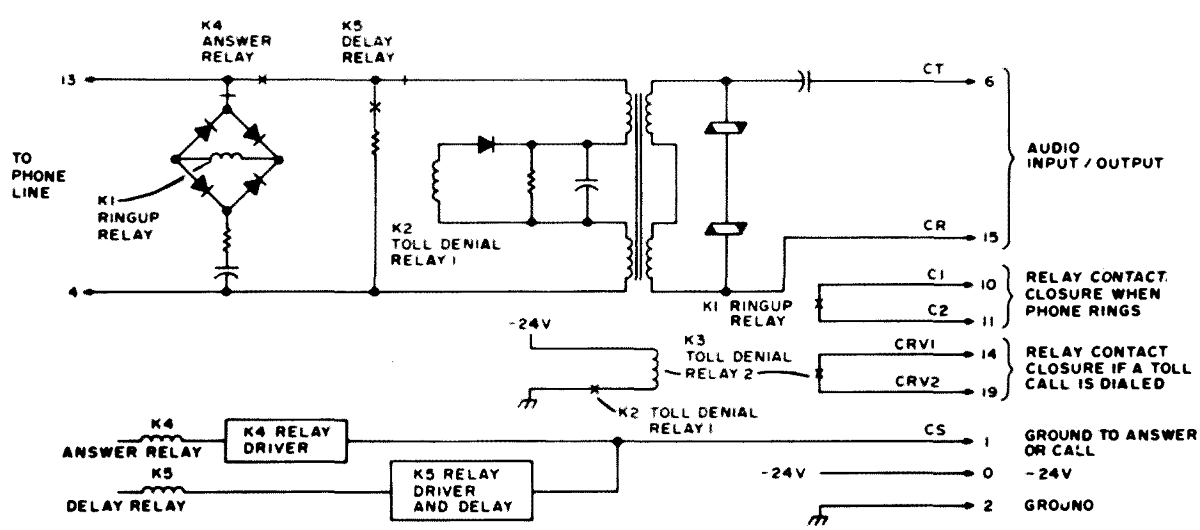

Fig. 11. Schematic diagram of the 102A IU (Interconnecting Unit) used in the CD7, CD8, CD9, CET, C2ACP, C2AKS Couplers. The 102B is similar.

the CD9 but for connecting a customer-owned push button telephone rather than a whole switchboard to the line. The C2AKS coupler is also just like the CD9 but for a slightly different application. Since the CD9 is for a switchboard, the CD9 would normally be on the line without having a regular telephone set connected as well; the C2AKS is intended for connecting other equipment to a line which already has a regular or push-button telephone on it.

Two other couplers which are very similar to the above in function although they are built completely differently are the CBS and CBT data couplers. Designed for carrying computer data by means of tone modulation, they handle voice and Touchtone signals just as well. The CBS uses digital logic signals for control and costs $6 a month and $25 for installation. The CBT uses relays and so is a bit cheaper – $4 a month and $25 installation. But the CBT needs an external 24-volt dc power supply. If you don't supply your own, the CBV supply will set you back an extra $1.85 a month.

The CBT works in a very similar fashion to the CD9, but whereas the CD9 has a single lead (CS) which controls both K4 and K5, the CBT splits this up into two separate control leads, one for each relay. You have to operate both control leads sequentially.

The CBT and CBS differ in two interesting respects, though from the CD9. First, the data couplers are normally supplied with a separate telephone which has an exclusion switch which can be wired so the coupler is normally on the line except when the phone is being used. I believe this means that if you add a CBT, for instance, to your home line which already has one telephone set, for the $4 extra you get not only a coupler but also a second phone.

The second difference is also interesting. The telephone company will normally not charge you for a call unless it exceeds about 1 second duration. You normally can't say much in 1 second, but a computer could send quite a bit of data in that time. And so the CBS and CBT couplers have a built-in time delay of 1 to 3 seconds which doesn't let you hang up too fast. More on this later.

. . . WHIPPLE

A. P. Stark VE3ZS
22 Lyall Street
Ottawa, Ontario
Canada

Getting Your Canadian License

Ham it up on your next vacation.

So you are going to Canada for a visit (or may be there on business) and want to take your rig along so that you can continue your mobile and portable activities. What to do?

In 1951 a treaty was signed between the U.S. and Canada entitled "Convention Between Canada and the United States of America relating to the Operation by Citizens of Either Country of Certain Radio Equipment or Stations in the Other Country." Because of this lengthy title it is usually referred to as "The Reciprocal Agreement."

It is under the provisions of Article III of "The Reciprocal Agreement" that the Federal Communications Commission (FCC) in the U.S. and the Department of Communications (DOC) in Canada may grant permission for licensed amateurs of one country to operate their stations while in the other country.

Administrative procedures have been kept to a minimum. To obtain the necessary authority, an American amateur should take the following steps:

1. Write to the DOC requesting Form 16-52. (See list of DOC addresses at end of article.)

2. Carefully complete *both* sections of Form 16-52 and mail it to the DOC Regional Office *nearest to your intended point of entry into Canada.* There is one exception; if you intend to cross the border into Ontario, send the form to the Toronto office. (See list of DOC addresses at end of article.)

In the section on the application form which asks you to specify the area of proposed operation and the time periods concerned, it is in order to state "Occasional (frequent, periodic, etc.) visits during 1975/76", or similar. There is no need to make separate applications for each visit; it only results in more paper work, and who needs that?

While instructions on Form 16-52 require at least 60 days to be allowed for return of the authorization or Certificate of Registration, this time is often shortened to 10 days. However, don't leave it until the last minute!

When you have received your Certificate of Registration from the DOC be sure to carry it (or a photostat copy) whenever you take your rig into Canada. The certificate will be recognized by Canada Customs officers at the border and will facilitate the entry of your equipment. Without the certificate, Customs may seal your equip-

ment or even require that you remove it and leave it at your port of entry. Should your equipment be sealed never remove or break the seal yourself while in Canada, even if you subsequently receive a registration card. Customs' seals may only be legally removed by a Customs officer. There are severe penalties under the Customs Act for tampering with or removing a Customs' seal.

In Canada there are only two classes of Amateur Radio Operator's Certificates – "Amateur" and "Advanced Amateur." These are considered by the DOC as the equivalent of the FCC "Conditional" and "General" and the "Advanced" and "Extra" classes of operator licenses. There is no equivalent of the "Novice" and "Technician" grades in Canada. This, in effect, means that U.S. Novice and Technician licensees cannot be granted reciprocal privileges and authority to operate their stations in Canada.

It should be noted that Canadian terminology concerning operator and station authorizations differ somewhat from that used in the U.S. In Canada, an individual is issued with an "Operator's *Certificate* of Proficiency in Radio" which authorizes him (or her) to act as an operator of a certain class or classes of radio stations. A "radio station *license*" authorizes the establishment and operation of appropriate radio equipment.

By legislation there is only one class of amateur station license in Canada; the subband frequencies which an amateur may use are governed by the class of operator's certificate held by the licensee. The holder of a professional First or Second Class Radiotelegraph Operator's Certificate does not have to hold an Amateur Operator's Certificate, since his professional certificate is of a superior class, and is entitled to all the privileges of an "Advanced Amateur."

At the present time Canadian legislation concerning amateur operation is contained in the "Radio Act" and the "General Radio Regulations, Parts I and II," which may be obtained from Information Canada outlets in Ottawa and other major Canadian cities. To the uninitiated, these, like many other government documents, are difficult to follow because of the numerous amendments and revisions. The Canadian Amateur Radio Federations Inc. (CARF) has produced a book entitled "The Canadian Amateur Radio Regulation Handbook." This publication contains extracts of all Canadian legislation relating to amateur radio as well as a layman's explanation of how the regulations are interpreted and applied. It is available from CARF Inc., P.O. Box 356, Kingston, Ontario, Canada, K7L 4W2 at $4.00 a copy.

List of Addresses of Department of Communications (DOC) Regional Offices.

Department of Communications, Room 300, 325 Granville Street, Vancouver, B.C. V6C 1S5;

Department of Communications, 2300 – One Lombard Place, Winnipeg, Manitoba R3B 2Z8;

Department of Communications, 9th Floor, 55 St. Clair Avenue East, Toronto, Ontario, M4T 1M2;

Department of Communications, 20th Floor, 2085 Union Street, Montreal, P.O. H3A 2C3;

Department of Communications, 7th Floor, Terminal Plaza Building, P.O. Box 1290, 222 Main Street, Moncton, N.B. E1C 8P9.

. . . VE3ZS

In Pursuit of the Perfect SSTV Picture

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An Expensive Chase

Several years of watching the unfolding of slow scan programs on 14,230 kHz made it obvious that there is room for improvement in several departments. Program material, for one – slow scan eats up television material almost as fast as commercial television – and how many times can you watch that tape of those girls from Florida? Lousy editing, resulting from the use of cheap tape recorders, is another. Apparently very few slow scanners have a tape recorder with a pause control. Jittery lines is another almost universal misery – and one that is easy to fix since all it requires is a better recorder.

The fact is that you can turn out usable slow scan pictures with even the cheapest of cassette recorders. The recorder used on the KC4DX trip was one of those $17 specials, yet the pictures sent out by it – even with only acoustic coupling to the transceiver mike – were good enough to give quite a number of alert slow scanners a new country. Pictures sent back to Navassa and recorded via the speaker were still plenty good enough to copy upon return to the States – including one retransmission of the KC4DX pictures!

The inexpensive cassette recorders are usable, but the pictures they provide are far from good. The easiest indicator of the problem is that fluctuating left edge of the picture. The problem, if you open up a few of these recorders, is simple to isolate – the tape drive is from a single motor and via a rubber belt – a rubber band. This is okay for the design function of these recorders – dictation – low fidelity recording – telephone taps – playing the 73 Morse Code cassettes – etc. But when it comes to an application where speed regulation is important that rubber drive belt is too bouncy and the drive moves ahead in incremental spurts, jiggling your slow scan pictures.

Well, you may say, of course you can't expect much from a cassette recorder which is manufactured in Japan, sold by the manufacturer at a profit to an exporter who, in turn, sells it at a profit to an importer in the U.S. – who then pays the shipping costs and customs duty, adds on his costs of business and profit, and sells it to a dealer – who again marks it up to cover his costs and profit – and sells it for $17. How much can the recorder be really worth? No wonder it is jumpy!

Perhaps we have to look at the medium priced cassette machines? It will cost you a bit, but look, if you like. You'll find that there is very little difference in the cassette drive mechanism, that the added costs have been put into fancier cases, bigger loudspeakers, more power, more controls, more flexibility – perhaps an ac power supply – or an AM/FM radio. The drive is exactly the same!

Hmmm. The next step is the $100 recorders – how about them? When you remove the back you'll see little change in the drive systems – one motor and a big black rubber band. Oh, you'll have stereo now, maybe even a counter hooked in, a pair of recording meters, and other accessories – but the slow scan picture you get still jiggles as badly as ever! You may even discover, if you try several of these recorders, that no two of those drive wheels are exactly the same – with the result that no two recorders will play back at the same speed. The variation is substantial and cannot only change the pitch of music so you can't

The Sony TC-152SD.

accompany it with your own instrument, but can change the speed of Morse Code by from a half to one word per minute if you use it for practice.

Your slow scan pictures will begin to settle down when you get into the better cassette recorders — the ones with two or three motors and wow and flutter down in the .05% range. Now you are in the $250 and up range, which may be a little rarified for just slow scan, even for perfectionists. You can adjust to the cost of this necessary unit if you also are interested in hi-fi and thus have a good second application for the cassette deck.

Recommended Decks

After trying many different recorders, certain features developed importance and the selection of truly great cassette decks narrowed. Since most amateurs will probably want a deck that is as ideal as possible for slow scan, useful for hi-fi and perhaps even good for portable use, the selection of decks is very narrow: one.

The deck must have that .05% wow and flutter — a pause control — a provision for monitoring the recorded signal — stereo/mono capability — monitoring meters — Dolby noise reduction circuit for music — bias for normal, hi-fi and chromium tapes — ac/dc power — mike/line inputs — and hopefully a placement for the cassette which permits hand turning of the tape for micro-editing — and maybe a built in speaker so the unit can be used as a tape player, too.

Although there are about fifty different manufacturers of cassette tape recorders, and probably over 250 models to choose from, only one meets these specifications — the Sony TC-152SD. One of these was bought from Henry Radio and tried out — it made all the difference in the world on the slow scan pictures.

The pause control made it simple to start the recorder instantly and catch the sync pulses which begin each picture. The editing of the cassette was very easy because the cover from the cassette pocket was removable and a tooth pick then could advance the tape or rewind it manually to get the exact spot on the tape.

The 152 soon was moving back and forth — into the hamshack for slow scan — back into the living room to tape Boston Symphony concerts — or to play endless cassettes of Scott Joplin as background music during the day at the office — then off to a convention to record with professional quality the talks being given. There have been so many applications for the 152 that it has been in daily use. Like the frequency counter and the microwave oven, once you get used to it you don't know how you did without it.

But what about reel to reel recorders? Oh yes, these have been in use in the shack and with the hi-fi system for many years. No doubt reel to reel machines will be around for many years, but as far as ease of use is concerned, they don't make it. They are big

and cumbersome; the tape is expensive, as well as difficult to thread and change; and the system for putting four channels on that quarter inch tape is insane. They stagger the four tracks! On cassettes the one-eighth inch tape has four tracks, but the two stereo channels are side by side going each way.

Whether you are going slow scan or music, the fact is that you want to be able to change tapes easily and quickly – and this means cassettes. The better cassette decks automatically turn off when the end of the tape is reached, so you don't even have to worry about that.

Cassette Lengths

Cassette tapes are available in several lengths, the most popular being 30, 40, 60, 90 and 120 minutes. The 40 minute cassettes were primarily designed for taping LP records, which generally run about 20 minutes per side. The cassette case seems to have been designed to be the right size to fit .003" thickness tape which will play 30 minutes per side – the C60 tape.

C90 tapes have to be made using thinner tape and there are some drawbacks to this – serious drawbacks. The thinner tape (.002") has a tendency to get jammed in the drive mechanisms of the cheaper recorders. You can get pretty fed up with the slight advantages of the 90 minutes of tape after pulling a foot or two of it out of your recorder and finding you have to cut the wrinkled mess out of the cassette and patch what is left together. Unless you have a lot of patience you'll quickly get very tired of repairing the fragile tape.

C90 also has a couple of other disadvantages – as if it needed more – such as having a lot more print through. As you may guess, print through is a transfer of some of the magnetic impression from one layer of the tape to another – giving you a ghost signal added to your music. Eery and useless. One last problem – some of your flutter comes back, despite the expense of the drive mechanism, three motors, etc. The tape is now so thin that it acts like a rubber band!

If there are problems with the C90 tapes you can just imagine the hassles with C120 tapes! These are .001" thick and are more valuable as a demonstration of the marvels of modern engineering than as tapes for hi-fi music or slow scan. Even on a $350 deck these sound lousy.

A word of warning regarding el cheapo tapes – don't. You may ignore that warning without explanation since the drive to get a bargain is stronger than reason in most people. As an example – one of the dealers in the Boston area has some very reasonable cassettes on sale – real bargain – perhaps. C60 tape at 65¢ each! Four for $2 – boy, let's have a couple dozen of those! Brand new, too! One educated look and you'll see

The Toshiba PT-490.

the kicker – the roll of tape in that cassette is a lot smaller than you are used to. Now how come a C60 cassette has a little tiny roll of tape in it? Right! They used .001" (one mil) tape so you have all the miseries of C120 without the single benefit – length.

Some junk cassettes will jam, spilling tape into the wheels of progress. Others will bind, aggravating any rubber band bouncing of the drive belts – etc. Unless you have a guarantee of refund or replacement, watch out. Since even the best of the cassettes sometimes come acropper, it is best to always be sure of your supplier and the fact that he stands behind the cassette . . . unless you would like to build up a series of interesting stories to tell friends about tape bargains you got which turned out to be disasters . . . like that bunch of C60s you got at the auction which wouldn't record.

Cassette tape comes in a bewildering number of brands and prices – in voice quality – music quality – hi-fi – chromium – etc. Voice is adequate for SSTV work – and for medium fidelity music. Beyond that it is a question of how high you want your highs to go and how low the lows. With a good machine and good tape your cassette will provide 20-18,000 Hz, which is about all you can want for hi-fi.

The Toshiba PT-490

One of the slight drawbacks of the C60 cassette is that it runs only 30 minutes on a side. Considering that 78 rpm records ran about 2-1/2 minutes for the 10" and about 4 minutes for the 12", with LP's running about 20 minutes per side, the 30 minute limit would not seem to be a serious problem.

Toshiba is one of the first to come up with a cassette deck which automatically reverses at the end of the tape if you want. It will even continue to play the same tape back and forth, over and over, if you set the control for that. This means that you can have the benefit of a one hour recording without stopping on a C60 cassette – losing only a few seconds during the turn around.

The PT-490 sells for $350 and has most of the sophisticated circuitry the hi-fi bug needs today. Obviously this is absolutely ideal for demonstrating slow scan television for dealers since the 490 will sit there and show programs continuously. It has the Dolby Laboratories noise circuit to overcome tape hiss, three bias positions, mike or line inputs, pause control, counter, individual monitor meters, and a special jack in the back which mates with other Japanese hi-fi units so you don't have to patch all those individual wires – in addition to the jacks for the individual wires, if you need them. There are individual input and output volume controls (the Sony 152 has only output volume controls and a volume control for the built in monitor amplifier).

Toshiba has stepped way out in front with the 490 in cassette deck design. Before that the Toshiba line had mostly been a bit behind the pioneers in the field – very good equipment, but conservative. Toshiba has some more pioneering cassette decks on the way, expected in a couple of months – probably in the $650 range. That's a far cry from the $17 cassette recorder.

. . . W2NSD/1

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AC Power for the HW-202

Or Any Other 12V Mobile Rig

The Heathkit HW-202 was designed primarily for use with an automotive 12 volt dc power source. However, this rig works very well as a base station with the power supply we are about to describe.

The power transformer that was pressed into service was a triad F-32A. This particular transformer has two separate 6.3 ac windings, each of which are rated at 3 Amperes. These windings were put in series to provide 12.6 V ac. It must be remembered that when placing two windings in series, they must be "in phase." When you first series the windings measure the resultant ac voltage. If it is not 12 V ac, one set of the windings must be reversed.

In the receive mode, the HW-202 draws about 100 milliamperes at 13 volts dc. This is with the squelch "on" and no audio present. This resting current will increase with audio; however, the average receive current is low. When in the transmit mode, the current increases to 2 or more Amperes at 13 volts dc. Therefore, it was necessary to design a supply which could provide in excess of the 2 plus Amperes needed in the transmit mode.

Just about any filament transformer with a single 12.6 ac winding or two 6.3 ac windings and adequate current rating (3 Amps) will suffice in this supply. Should nothing be available in the junk box, an old TV set transformer can be used if space is of no concern.

The high voltage windings can be taped up and just the 6.3 ac and 5.0 ac windings placed in series. In older TV sets, the 6.3 winding provided normal tube filament voltage and the 5 volt winding took care of the 5U4 rectifier. Both of these windings generally were capable of considerable current.

These two windings in series will provide about 16 V dc after the rectifier bridge and is adequate to supply the regulator which is working at 13 V dc.

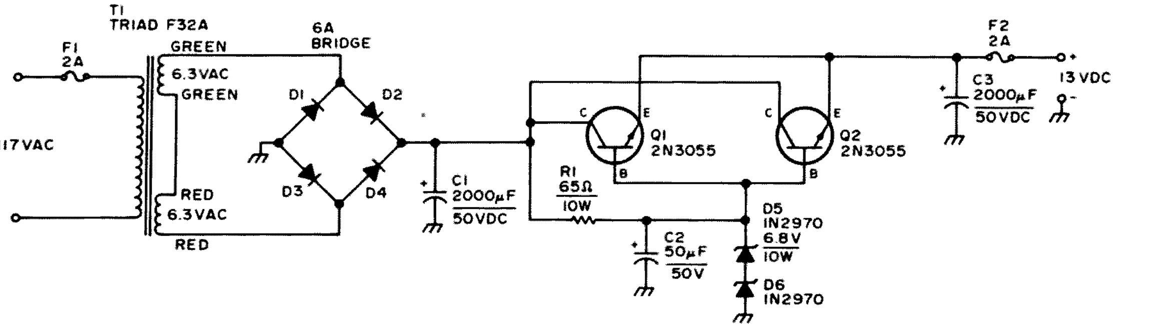

Fig. 1. HW-202 regulated 13 V power supply.

The rectifier is an "encapsulated" bridge that can be obtained at Radio Shack outlets. These particular bridges should be mounted directly on the chassis which acts as a heat sink. Radio Shack sells two different bridges that are rated at 50 volts, 6 Amps and 200 volts, 6 Amps. The 200 volt, 6 Amp bridge is more conservative and tolerant of line surges, and thus might be a better choice for the supply. Of course, individual diodes can be used in the bridge but should be able to withstand the necessary current.

Nothing bothers us more than having components run "hot" under a normal load. Therefore, a pair of 2N3055 pass transistors were used to regulate the 2 Ampere load. The 2N3055 will handle up to 4 Amperes so the pair easily handles the 2 Amps.

Although 12.6 ac is put out by the transformer, the bridge rectifier produces approximately 16 to 18 V dc. The pair of 1N2970 zener diodes in the base circuit of the 2N3055s holds the output voltage down to 13 V dc. The 65 Ohm, 10 Watt resistor limits the current to the zener diodes so that the dissipation of the diodes is not exceeded.

The reason that two 6.8 volt zeners were placed in series was that we did not happen to have a 13.6 volt zener handy. A 1N2979 (15 V/10 Watt) might be used but the output voltage might be a bit high . . . in the neighborhood of 14 V dc.

Of course, the use of this supply is not limited to use with the HW-202. Just about any of the modern transistor type mobile FM rigs in the 10 Watt power range will work well with this supply. Our particular unit has been in use for nearly one year with no problems at all.

Power Supply Parts List

C1, C3 – 2000 uF, 50 V dc electrolytic capacitor.
C2 – 50 uF, 50 V dc electrolytic capacitor.
D1-D4 – 200 volt, 6 Ampere encapsulated bridge (Radio Shack).
D5-D6 – 1N2970, 6.8 volt, 10 Watt zener diode.
F1 – 120 V ac, 2 Ampere fuse.
F2 – 12 V dc, 2 Ampere fuse.
Q1-Q2 – 2N3055 NPN silicon transistor.
T1 – Triad F-32A transformer, 115 V ac primary, two 6.3 V ac, 3 Ampere secondary windings.

. . . W2AOO

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Now What Have I Done?

Here is a simple circuit, Fig. 1, that makes an excellent one evening project and can result in lots of fun. It relies on the fact that man is of a very curious nature and doesn't really believe everything that he reads. The circuit is mounted in a small minibox. The push-button is labelled *Do Not Touch* in plain writing and very visible. Now, anytime you label something *Do Not Touch* somebody is bound to touch it. . .it never fails! It's human nature. The person whose curiosity has gotten the best of him, however, will get very red faced and embarrassed when he finds there is no way to turn off the noisy thing that he has just started. How does it work? Very simple, the power to the two transistor oscillator is controlled by an SCR. When you push the button you gate the SCR causing it to conduct and the audio oscillator to run. Once an SCR has been gated and is conducting there is no way to shut it off unless you disconnect the power or reverse the polarity on the diode. It is at this point that the poor fellow who pushed the button says *Now, what have I done*. In this circuit we disconnect the power and stop the noisy oscillator by means of a magnetically controlled normally closed reed switch. I made the reed switch normally closed by glueing a small magnet to it with some epoxy glue. The small magnet glued to the side of the reed switch causes the switch contacts to be closed all the time. However, if you place a slightly larger magnet near the already closed reed switch it will oppose the magnet that is glued to the switch and the points will open as long as the magnet is held in close proximity to the switch. Mount the reed switch against the inside edge of the plastic or aluminum minibox (don't use a

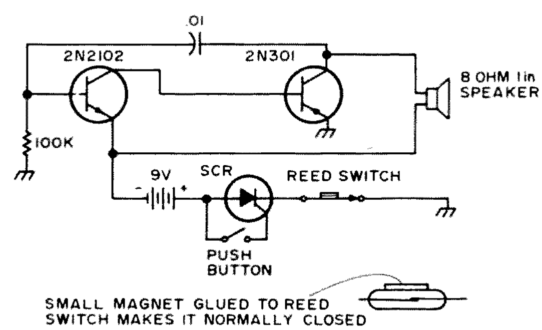

Fig. 1.

steel box or the magnet will not work). When you want to shut off the oscillator simply rub the magnet against the outside edge of the box where the switch is mounted. The magnet will open "the points" and the unit will shut off. Unless the unsuspecting victim carries a magnet with him there is no way he can shut it off. I built mine in one evening completely out of junk box parts. Almost any two transistors will work as long as one is NPN and the other is PNP. The SCR that I used came out of a bag of assorted untested SCRs that I bought for $1.69. I tried four different SCRs out of this assortment of ten and all of them worked with no difficulty so the SCR is not very critical. You could also replace the push-button with a mercury switch if you wanted to be real nasty and the oscillator would start as soon as somebody picked it up. An excellent portable burgler alarm. After you build it just leave it on your desk and it won't be long before some poor soul gets just a little too curious. I leave mine in the Ham shack on the bench and everytime I get a visitor he picks it up, looks it over and pushes the button. Never fails.

. . . VE3FEZ

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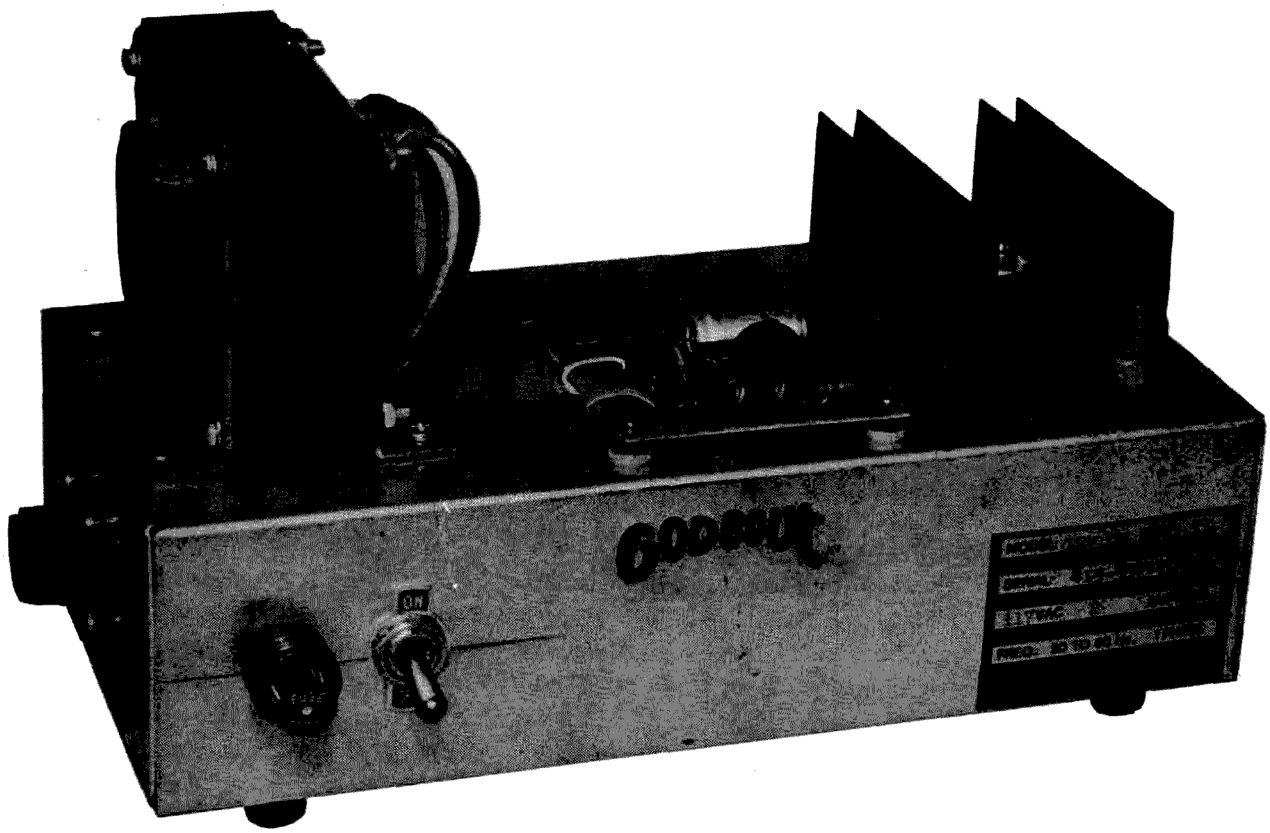

A Hefty 12 Volt Supply

If you've ever needed a good, regulated 12 volt power supply, for powering your mobile rig while at home or just to sit on your test bench, this is the one. It provides an adjustable output over an 11 to 14 volt range, keeping regulation to better than 100 millivolts. The output is set to current limit at 6.5 Amperes (although you can change that to 13 Amperes). Additionally, the power supply is protected against transients and reverse voltages at the output terminals.

Fig. 1 shows a conventional regulated high power supply. Using a 723 voltage regulator gives the necessary precision and regulation; a hefty external pass transistor, complementing the 723's internal pass transistor, provides the power. Although this type of circuit works reasonably well, making a few circuit changes can achieve far better performance.

Modification number one is to use a Darlington power device as the pass element. The MJ3000 specified has a gain of 1000 at 5 Amperes. This high gain requires less base current, keeping a light load on the regulator. The actual amount required to drive the MJ3000 is about 1.5 mA per Ampere of output current. Taking the 723 quiescent current into account, the 723 is left with a worst-case current load of under 12 mA, promoting a stable and cool-running regulator section.

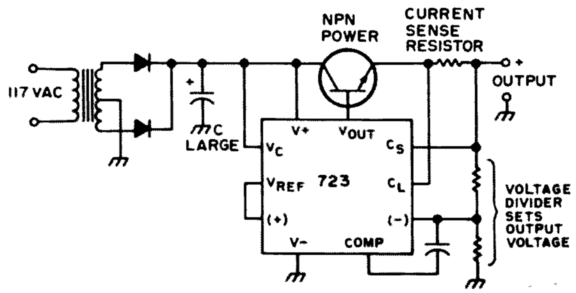

Fig. 1. Conventional regulated high current supply.

To understand modification number two, it's necessary to look at the schematic (Fig. 2) and fool around with some numbers.

With a conventional capacitive input filter (which this is), ripple voltage increases linearly with output current. Despite the large amount of capacitance (5 paralleled 4000 uF caps for a total of 20,000 uF), in a situation where you're drawing 6.5 Amperes there is a ripple voltage of about 3 volts peak to peak across the filter bank. Like all IC regulators, the 723 must have a somewhat higher voltage at its input than at its output in order to maintain regulation (typically 5 volts). If we were to take the input to the 723 from the filter capacitor output, as in the typical configuration of Fig. 1, there may not be enough drive to maintain regulation. Hence, in Fig. 2, we take a couple of diodes and another filter capacitor and derive the input voltage directly from the transformer secondary. Due to the light load current on the 723 discussed earlier, we can get away with a 250 uF capacitor; at 6.5 Amperes of output current, this means a ripple of 300 millivolts peak to peak at the regulator input, which is certainly enough to keep the 723 happy and regulating.

A few other points are worth mentioning. Bypassing Vref to ground with a small tantalum capacitor substantially reduces any noise and ripple appearing at its output. Another point to consider is temperature stability (i.e. constant output voltage regardless of temperature). Resistors R1, R2 and R3 set the output voltage; since we're using carbon composition resistors, you might think the stability would not be too good. However, what matters in this case is the resistance ratio rather than absolute values. Since for 12 volt operation the trimpot is in its approximate mid-range position, any temperature variations tend to change all resistances equally, preserving the proper ratio and giving a constant output voltage. One extra point to consider: by tagging a resistor on the output to give a small minimum load, the regulator is always in its active state, maintaining better stability and accuracy. The tantalum capacitor connected across the output improves transient response.

Finally, at the extreme output of the power supply is a diode. Note that it's connected up to shunt any negative spikes or

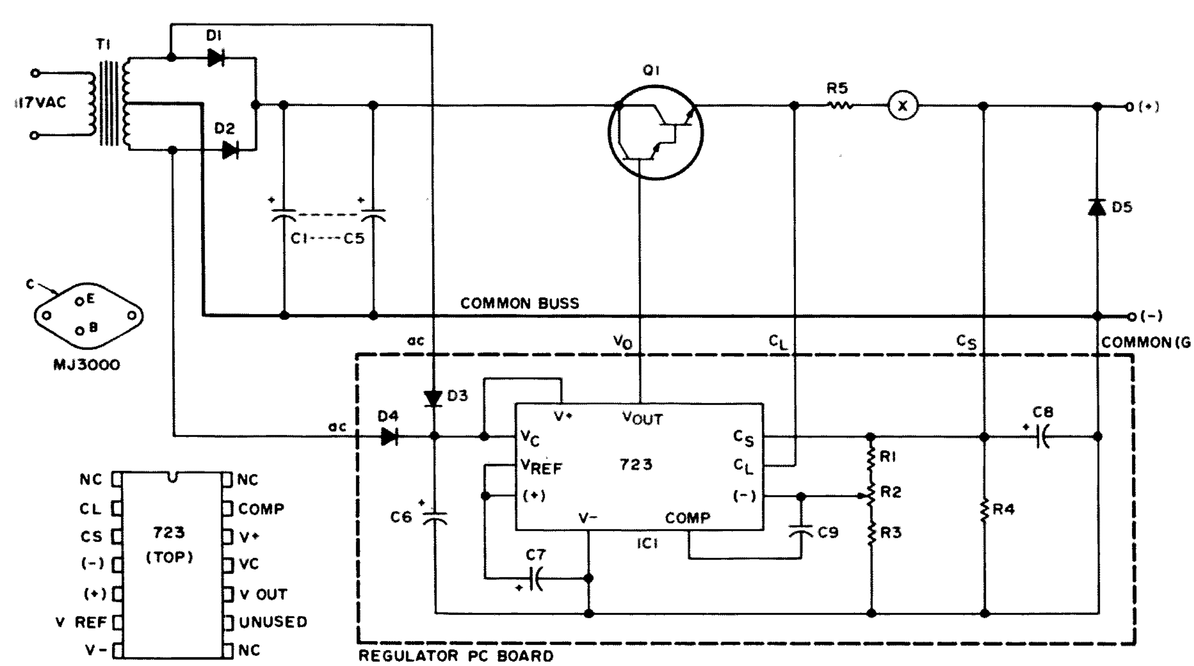

Fig. 2. 12 V power supply schematic. MJ3000: bottom view; C – case.

TOP VIEW

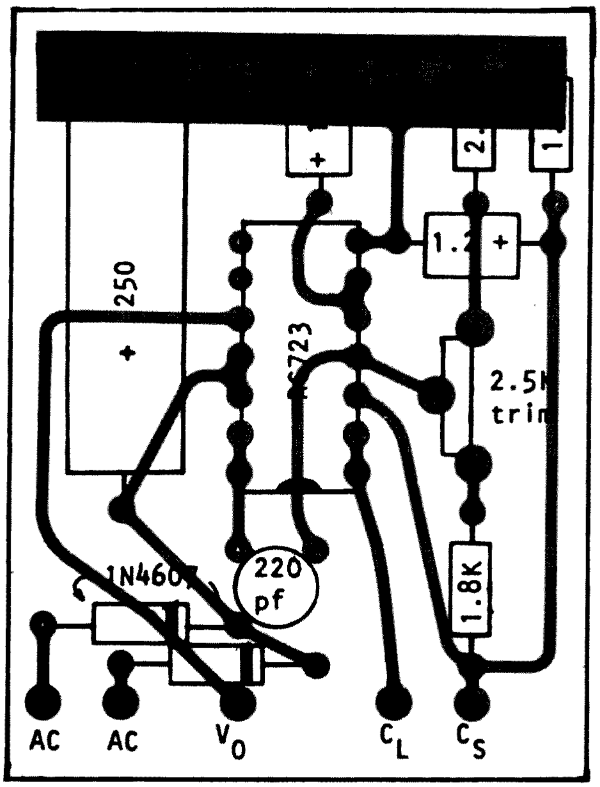

Fig. 3. PC board and parts layout (83.3%).

transients to ground before they can get into the power supply and cause any trouble.

One protection device that is not necessary but highly desirable is a fuse; in case anything should go wrong with the supply, it protects the device being powered. Because a fuse has a small amount of resistance, it should be inserted at point "X" on the schematic rather than at the supply's output. Even a resistance measured in milliohms can cause a measurable voltage drop at heavy output currents.

As far as assembly is concerned, the 723 and its associated components mount on a separate printed circuit board (Fig. 3). Six connections are made to this board, as shown in the schematic: 1 to the negative buss; 2 to the transformer secondary; 1 to the base of the MJ3000; and 2 across the current sensing resistor. The MJ3000 and the current sensing resistor should be mounted on a good heat sink. (Remember, this is a powerful device.) The transformer, filter capacitor bank, and rectifiers stand by themselves. Use heavy gauge wire to minimize any resistance. Also note that bussing together the negative line rather than grounding it gives a floating output; this is particularly useful in service bench and lab supply applications.

The .1 Ohm resistor given in the schematic, as mentioned before, limits current to 6.5 Amperes, plus or minus 5%. However, the transformer, diodes and MJ3000 can provide up to 8 Amperes continuously with good ventilation, or 10 Amperes intermittently. To change the current limiting point requires changing the value of the current sense resistor. Paralleling two .1 Ohm resistors gives a current limit point of 13 Amperes, sufficient to protect against momentary shorts.

(Postscript: Using these same principles can give power supplies capable of delivering up to 100 Amperes of regulated current. All that is required is making a more powerful transformer-diode-heat sink combination, increasing the filter capacitance, and paralleling an appropriate number of Darlington devices, adding a small value resistor on the emitter of each Darlington.)

Parts List

R1	1.8k ¼ Watt 10%
R2	2.5k trimpot
R3	2.7k ¼ Watt 10%
R4	1.5k ¼ Watt 10%
R5	.1 Ohms, 5 Watts or greater (see text)
C1-C5	4000 uF @ 20 volts
C6	250 uF @ 25 volts
C7, C8	1.2 uF @ 35 volts
C9	220 pF @ 25 volts
D1, D2	Rectifier diode @ 6 Amperes (Motorola MR1120 or equivalent)
D3, D4	1N4607 or equivalent
D5	1N4002 or equivalent
Q1	MJ3000 (Motorola) Darlington power transistor or equivalent
IC1	LM723 integrated circuit
T1	24-28 volt center tapped transformer @ 4 Amperes
Misc.	Line cord, chassis, mica insulators plus silicone grease, heavy gauge wire, fuse and fuse post, binding posts, etc.

A kit of parts including the regulator circuit board but less items listed under "misc." is available from Godbout Electronics, Oakland International Airport, California 94614 for $18.95 plus postage. The MJ3000 is available also for $1.95; for orders under $10, add 50¢ handling.

. . . ANDERTON

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ICM Kit 2m Converter

This article describes a remarkable two meter converter made with four of those little 1½" x 1½" printed circuit boards from International Crystal. The total cost is only $17.50 and includes the control crystal, two rf stages, mixer, oscillator, and all the transistors.

I have assembled to date over a dozen of the International Crystal printed circuit kits and every one of them has performed exactly as claimed by the manufacturer. I have also taken advantage of certain techniques (mainly collector tuning) and have externally added two features which improve performance considerably. These added features you can treat in any of the following three fashions. 1. Do not include them. The converter still works fine. 2. Use them, and then if you decide to take them out again, do so. It's easy because they are external to the printed circuit boards. 3. Use them, and the converter really brings them in.

Each of the kits goes together in less than an hour. After allowing a little more time for cabling, battery connections, and possibly a "Long John" Yagi, you have no excuse for not hearing everything on the band.

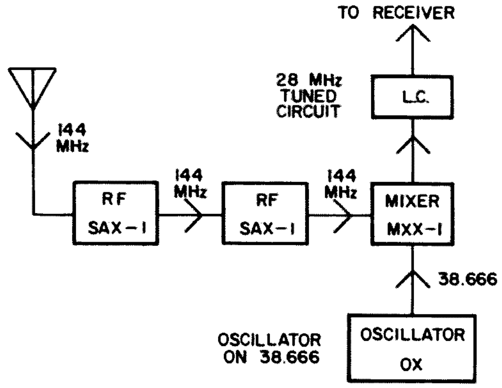

Fig. 1. Block diagram, two meter converter using International Crystal kits.

The Rf Stages

I am a confirmed believer in more than one rf stage for VHF. It does a great deal for you. The in-band signals are there, they're loud, and they swamp out all spurious signals, birdies, and other annoying factors. One of these rf stages is a home brew job because of my not remembering to order two rf units from International. However, I checked the gain of both the International and the home brew one and they're both good, so the International wins because it costs only $3.50 and takes just an hour to build.

The circuit is shown in Fig. 3. One of the external "gadgets" was added to this stage. This is shown in Fig. 4 and is nothing more than a mica compression trimmer soldered

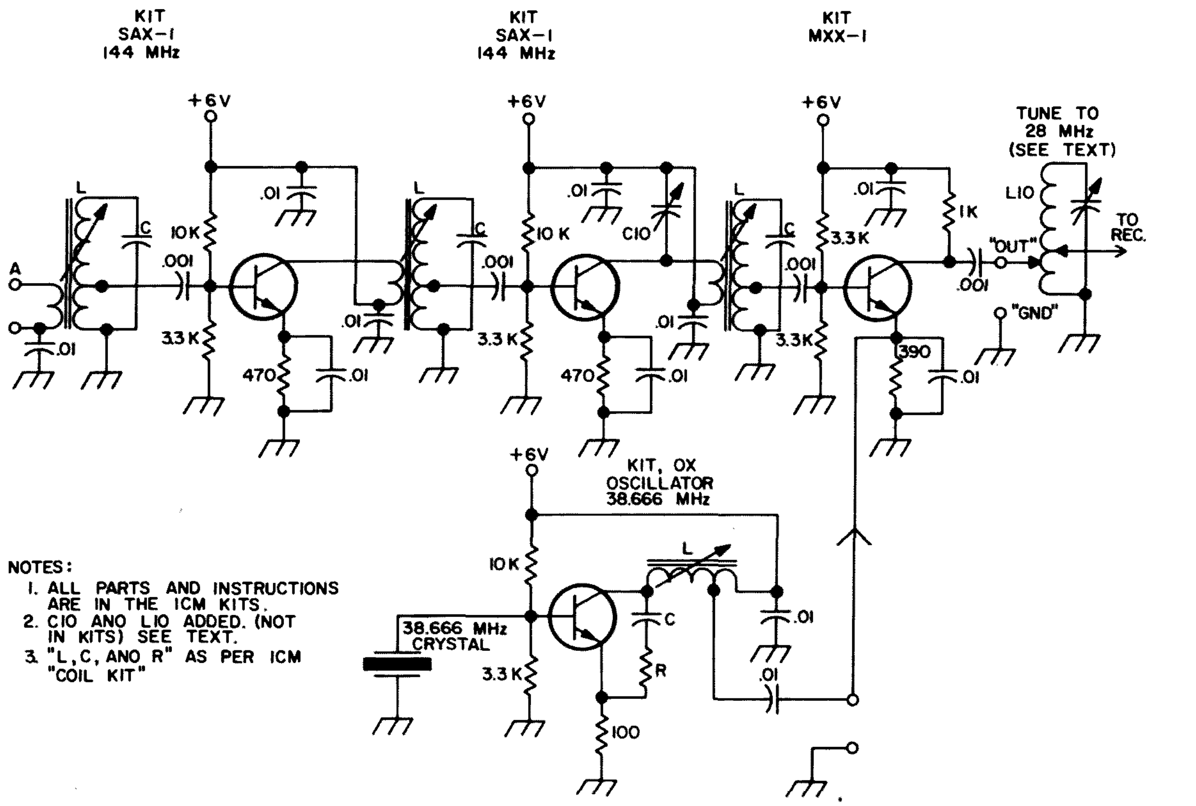

Fig. 2. Over-all circuit, two meter converter using International Crystal kits.

across the output terminals of the SAX-1 board and a special length of cable going to the one turn link in the mixer input. This tunes the collector circuit, as you can easily see in Fig. 4, with the coaxial cable forming the inductance. It works very well, giving much more rf gain into the mixer, and forming an additional in-band filter. In fact, if the mixer coil L2 is not properly tuned to resonance and loading the collector circuit, which is now being tuned, it is possible for it to oscillate due to the base already being tuned, as in Fig. 3.

With the mixer properly tuned this will not happen, and the rf stage gain will show a large increase.

Remember the caution mentioned earlier,

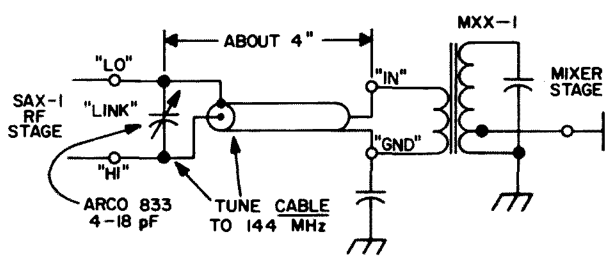

Fig. 4. Tuned collector for SAX-1 rf stage. Note: The tuned circuit in the output of SAX-1 is about 4" long including the phone plugs.

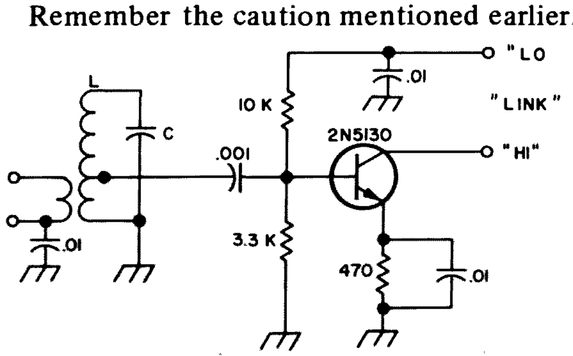

Fig. 3. SAX-1 International Crystal kit, 144 MHz rf stage.

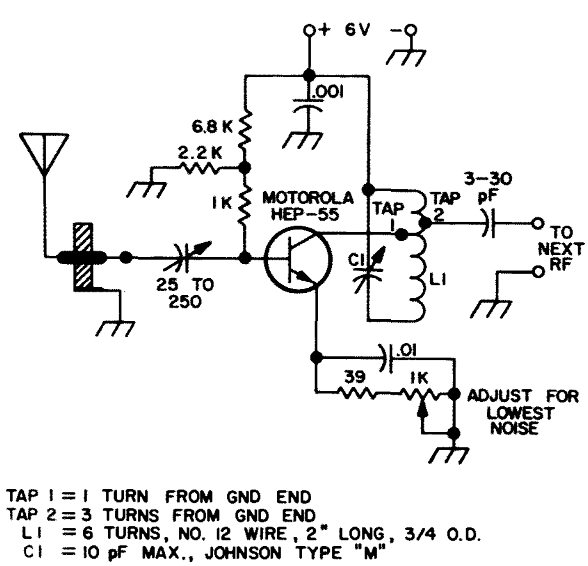

Fig. 5. Second rf stage, 144 MHz (shown nearest the antenna in Fig. 1).

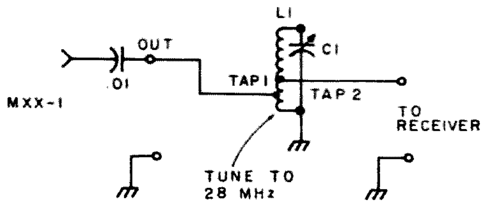

Fig. 6. Adjust taps 1 and 2 for best gain and/or bandwidth desired. L1 – 6 turns No. 14 wire, 1 inch long, 7/8" diameter. C1 – ARCO 426, 35 to 275 pF.

that you can remove this extra capacitor any time if you don't like its action.

The Second Rf Stage

This is shown in Fig. 5 and is a very simple affair to build, but even so it takes a lot longer than the International kit because it is not on an already printed board with all the parts in a plastic bag ready for you. So that is why I advise getting two of the rf stages right off. You will notice in this home brew job that the collector is tuned and the base is not. If you wish to use a tuned circuit into the base, the circuit of the SAX-1 board is good. Adjust the base tap so that no oscillation occurs. With the untuned base as shown in Fig. 5 you will not get any oscillation.

And if you order the kits after reading this article you will probably get two of the International rf stages, so that's it for the rf section.

The Mixer Stage, MXX-1

This kit went together, like all the other International jobs, with no trouble and in about an hour. Here again I decided to use a 5 pF capacitor across L1 instead of the choice of 6.8 pF tuning to 145 MHz or the 4.7 tuning from 145 up. These values were evidently not selected by a two meter

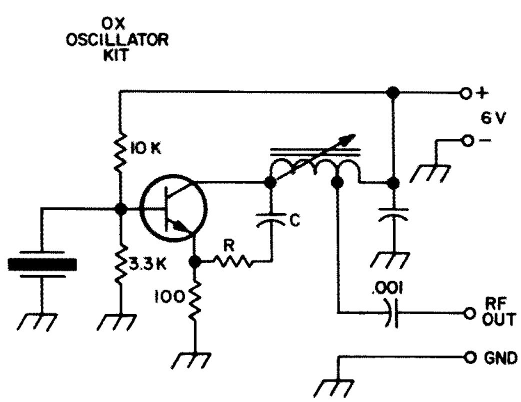

Fig. 7. Local oscillator, 38.666 MHz.

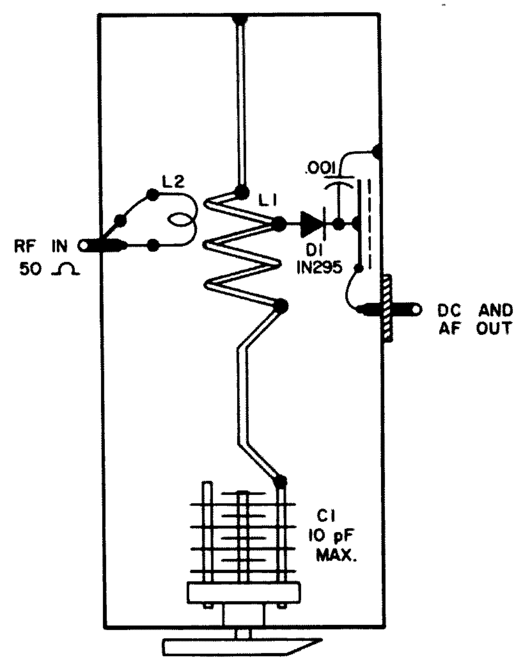

Fig. 8. Tuned diode test receiver, 100-200 MHz. L1 – 4 turns 9/16" long, 9/16" outside diameter, No. 16 air wound. L2 – 1 turn, movable, loose, over cold end of L1.

amateur, but with the 5 pF used for the "C" it adjusts fine over the two meter band.

Now comes the second outboard unit added. This one is recommended by the International Crystal people, as shown in

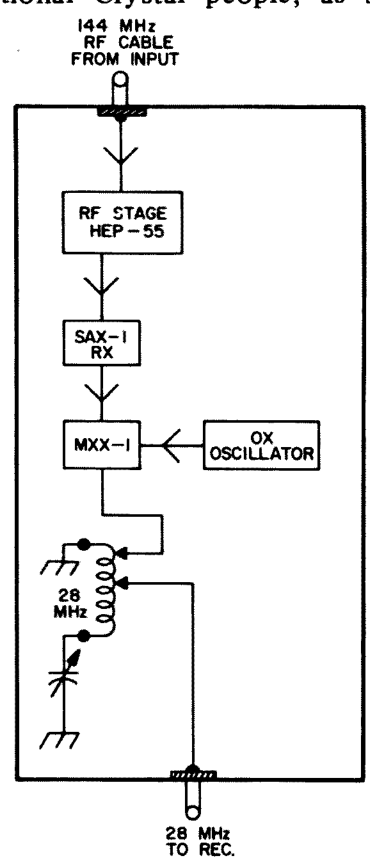

Fig. 9. Assembly layout, converter, International Crystal kits, two meters.

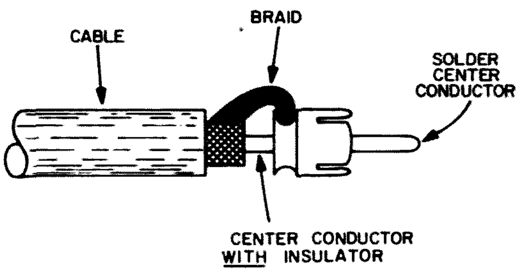

Fig. 10. RG 174/U cable and plug.

Fig. 6, and they say "connected to the receiver through a tuned circuit as indicated below" (Fig. 6). Having tried this out on the six meter converter and having found that the mixer output into the receiver was brought up very considerably, I installed it as the kits were assembled onto converter baseboard. It did the same for the two meter converter as for the six meter one, so don't leave this one out, unless for some reason you wish to tune over a much larger frequency range than one of the amateur bands. To broaden the tuning range of the circuit shown, place the taps shown in Fig. 6 up a little more towards the hot end of the 28 MHz tuned circuit.

On the mixer board the L can be peaked up easily on two meters with the threaded slug core while listening to stations, unless you have a well-shielded and properly attenuated signal generator on 144 MHz. The usual $30 to $40 job will not do on 144. For a test signal on 144, I use a 10 uW modulated crystal-controlled source installed about one-half mile away and use it to check between the International converter and my

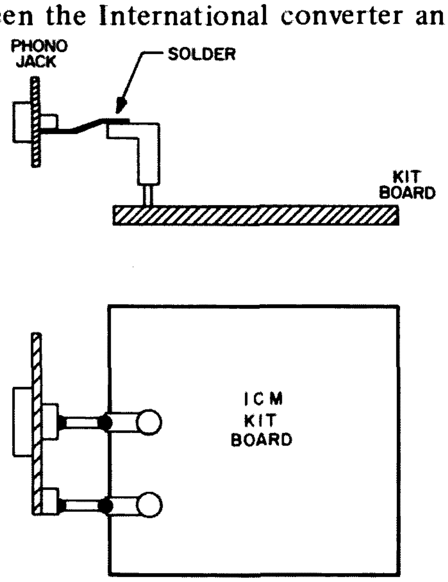

Fig. 11. Phono jack and International kit board connectors (side and top views).

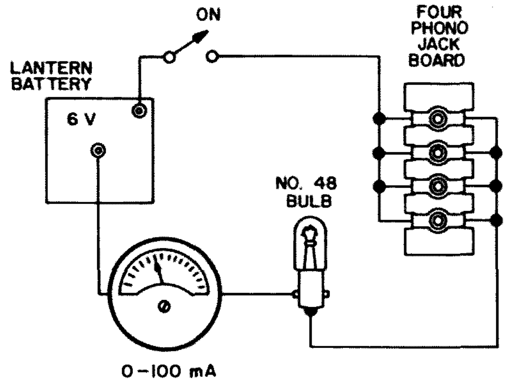

Fig. 12. 6 volt battery bench supply.

faithful old tube job using Nuvistors, as detailed later. Nothing more to say about the mixer. It works!

The Local Oscillator

With our receiver on ten meters, the converter crystal-controlled local oscillator should be on 116 MHz. The MXX-1 instruction sheet says "for injection signals from 120 to 180 MHz divide by three to determine the OX oscillator frequency." This calls for a crystal on 36.666 MHz, which we had ordered, and as soon as the oscillator kit was assembled and soldered, there was the 38.666 energy at the output. Figure 7 shows the circuit. Checking it out on 116 MHz for third harmonic content, a good volt of rectified dc was found at the output of the tuned diode test receiver on 116 MHz. This useful piece of test equipment is shown in Fig. 8, for the benefit of new readers. This unit can be built for almost any frequency up to about 1 GHz.

The local oscillator was now ready for assembly with the other units.

Assembling The Converter

Figure 2 shows the overall circuit. Each unit was mounted a little way off the baseboard on a single brass 6/32 machine bolt which was soldered vertically to the baseboard, so the printed board would clear

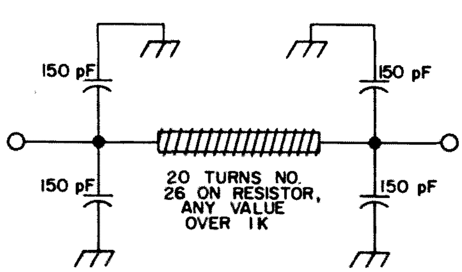

Fig. 13. Rf filter for battery leads, if needed.

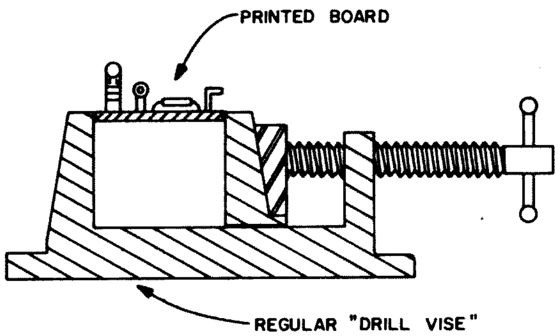

Fig. 14. Holder for soldering boards.

the baseboard and not have any of the wiring or solder points touch and short. Small coaxial cable type RG174/U, which is 3/32 of an inch O.D. was used to connect together the various units, along with phono jacks and plugs. The layout on the bread-board type baseboard is shown in Fig. 9. Signals from the bench generator were heard as soon as everything was connected, the various coils were peaked up, the outboard rf stage built and installed, and its taps varied to match the collector of the Motorola HEP55 transistor and the output cable to the SAX-1 International second stage.

Tricks and Tools of The Trade

As mentioned above, the use of the small rf cable type RG174/U helps with the 1½" boards for inter-connecting the units and carrying rf to the various test planks on the bench. A number of "phono" jacks and plugs are used for this work also. Some "purists" don't like to use these low-cost connectors, but I built the whole solid state 432er, crystal-controlled transmitter and triple conversion receiver using them as interconnectors and they worked fine. You can suit yourself on this question. They're not very good for outdoors of course, but they do have porcelain inserts for insulation and will carry 432 MHz, on a test basis, indoors. The plugs cost 3½¢ each at Lafayette, and the jacks 5¢. 'Nuff said. Fig. 10 shows a method of connecting them to the small cable.

Receiver Requirements

You need a receiver to follow your converter, and there are certain things this receiver should have or you will suffer on two meters and up. The most important turns out to be, not selectivity, gain, avc, or noise limiting, but image rejection. And right

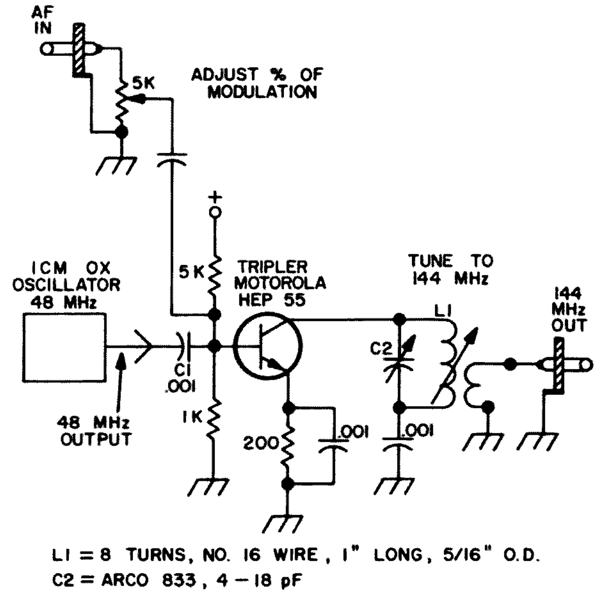

Fig. 15. rf test signal 144 MHz.

after that is a good smooth dial, easily turnable and handy for logging and/or calibration. The receiver I use is a full coverage one from .5 to 54 MHz, and as such has an i-f of 455 kHz. It is a good one, but on two meters following a single conversion the use of a 455 kHz i-f results in a bad image problem. One of the loudest stations heard on the band comes in equally well on 28 and 29 MHz on the receiver dial. Actually these points are 910 kHz apart. So you couldn't tell at first glance whether he was close to 144 or 145 MHz. A double conversion receiver with the first i-f on 1.65 MHz improves this situation greatly, especially if it has a three gang variable tuning capacitor with a tuned rf stage.

A Super 24 Foot "Long John"

Having manufactured amateur beams for over six years I can recommend this one, because I tuned it up on my own antenna

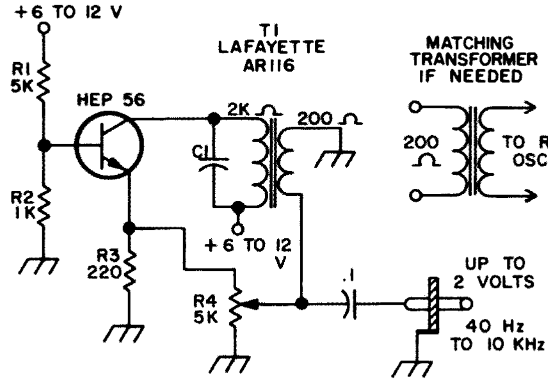

Fig. 16. Handy tone modulator for test signal. The value of C1 controls the af frequency.

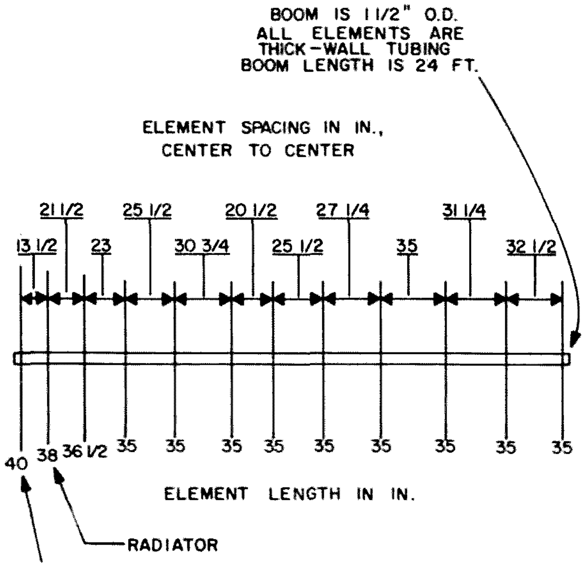

Fig. 17. Two meter "Long John" yagi.

range and have compared it with a number of other beams. I believe that this beam has the most gain possible for a 24 foot boom. I could include the design of my favorite 36 footer, but that kind is generally used only by two meter fanatics.

Figure 17 shows the 24 foot job with element lengths and spacings. The boom is made up of two twelve foot sections of 1½" tubing with a come-apart joint in the center for carrying up mountain tops. It is tuned up for maximum forward gain right now, so do not change any dimensions.

The elements are particularly useful for experimental and hilltop use as they can be bent accidentally several times without breaking. This is because they are not made

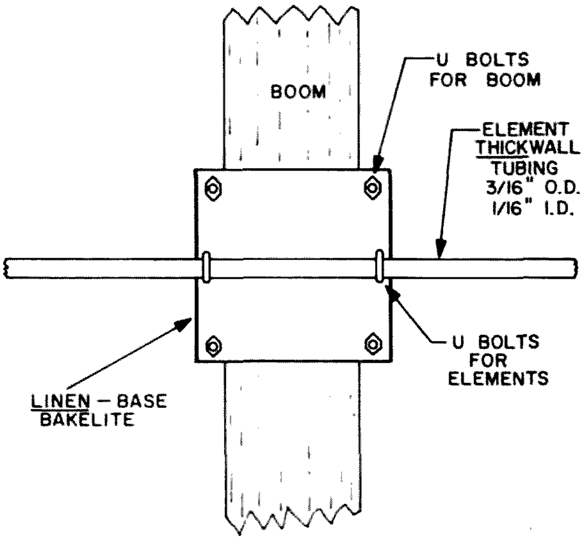

Fig. 18.

with thin wall tubing, but instead are of thick wall stock. Try them and see how they act.

Figure 18 shows some details of the element mounting on the boom, and Fig. 19 details the gamma match.

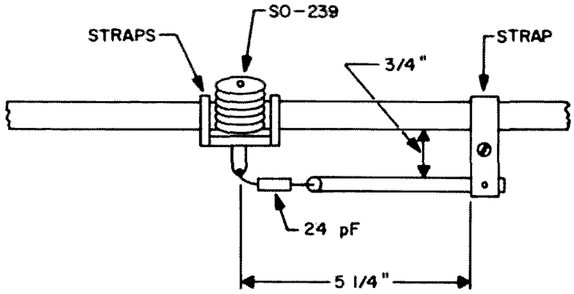

Fig. 19. Gamma match detail.

This is one you can hear W2's with every night up here in New Hampshire.

Conclusion

I hope this article on an excellent two meter battery converter from inexpensive kits will help you get acquainted with the band and spark you into going mobile – and hill-topping as well.

. . .K1CLL

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Updating the Pocket Mate

Since I wrote the article on converting the G.E. Pocket Mate to 2m FM (October 1973, 73) I have come across several changes and additions that will improve the performance of this tiny transceiver. A couple of them (modifying the driver and increasing deviation on low-audio units) are almost mandatory. These changes are simple provided you have tools designed to work on tiny circuitry.

Increasing Drive

On some units it is impossible to get a Watt out, even with the drive pot(s) at maximum. The reason usually is that the driver will not tune low enough, even with the slug all the way in the coil form of T-10. Adding a small capacitor (ceramic or mica) to the designated place will cure this, and T-10 will peak with the slug approximately one third to one half of the way in the form. Some units have one of several different values ranging from 3.3 to 6.8 pF here, while others that used to operate over 160 MHz or so had none. If yours has a 6.8 pF capacitor already, that should be sufficient capacity. You can tell if this stage will tune low enough by seeing if there are two peaks as the slug is turned all of the way through the coil. There should be two.

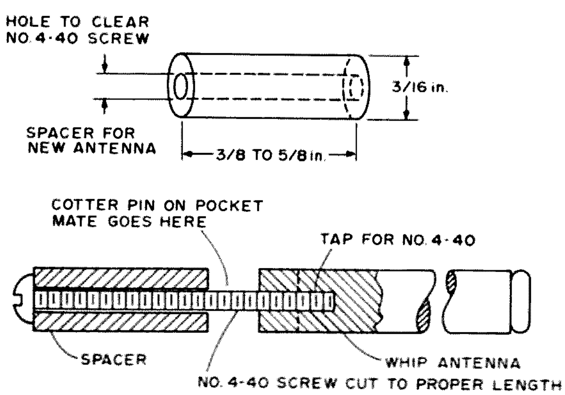

Fig. 1. Antenna mounting details.

Another Antenna

If your unit has a bent up or otherwise unsatisfactory whip antenna, it is fairly easy to replace with a new (and better) one for less than a dollar. Many electronic and TV shops sell a wide variety of replacement telescopic whips for TV sets and FM radios. The assortment usually includes a 5 section one that is about 12.7cm (5") collapsed and 45.72cm (18") extended. This makes an ideal antenna for 2m and it is easily adapted for the pocket mate, see Fig. 1. The mounting hardware is discarded and the tapped stud on the bottom of the antenna is sawed

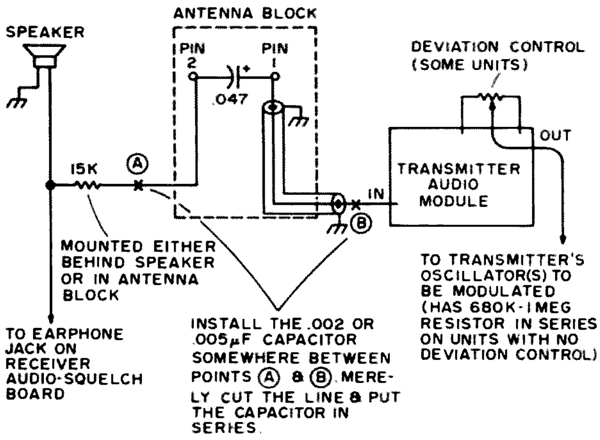

Fig. 2. Partial schematic of the Pocket Mate's audio system.

off. A 4-40 hole is then tapped in the same spot. When you do this be sure to keep from twisting the base loose from the first section. Sweat soldering the base to the first section will help prevent this. A spacer is then made from any kind of metal. A 4-40 round head screw then goes through the spacer, through the antenna cotter pin and is screwed into the base of the antenna. This method of mounting provides *much* more strength than can be obtained by mounting it with the hardware supplied with the antenna.

Improving Transmit Audio

If your unit still has bassy audio, even with tape behind the speaker, try putting a .002 μF capacitor in series with the wire going to the input of the transmitter audio module (see Fig. 2). It can be placed in series with the 15k resistor at the speaker, or it can be put in the line going directly to the audio board. There is not much room, but it can be done if you have a small capacitor. If you end up not having enough audio, you may have to go to a .005 μF, although it will not limit the low frequency response as much.

Adjusting Deviation

This is just a clarification on a comment in the earlier article. Fig. 3 will assist you in locating the resistor that can be changed to determine the deviation level. Units with deviation pots usually have compression circuitry in the audio module while these usually do not. If you have one that has too much compression, the .002 μF capacitor mentioned earlier will tend to reduce it as well as limit the low frequency response.

External Antenna and Power Supply

It is possible to make good use of this radio other than using it just as a walkie-talkie. By making the appropriate connections, you can connect it to an external power supply and/or antenna (see Fig. 4). The three connections for doing this are made to the antenna block. Resistor wires (1-2 Watt) will fit the small pins, and miniature banana plugs or bent, springy wire will be useful for connection to the antenna eyelet — or you can connect an external antenna to the antenna's cotter pin with an alligator clip.

You can go one step further and connect a low impedance microphone between pins 1 or 2 (experiment to find which give the best audio) and ground, and connect the PTT line from the mike to pin 4. An external 2m amplifier can be inserted in the antenna lead between the pocket mate and the antenna; you will then have a complete, higher power, push-to-talk transceiver.

If you have gone this far, and you operate in a noisy mobile, you may want to go the last mile and plug an external 45-100Ω speaker into the earphone jack. It is located on the audio-squelch board cover, and you will need a subminiature earphone plug. It is amazing how much louder a 7.62cm — 10.16cm (3"-4") speaker sounds.

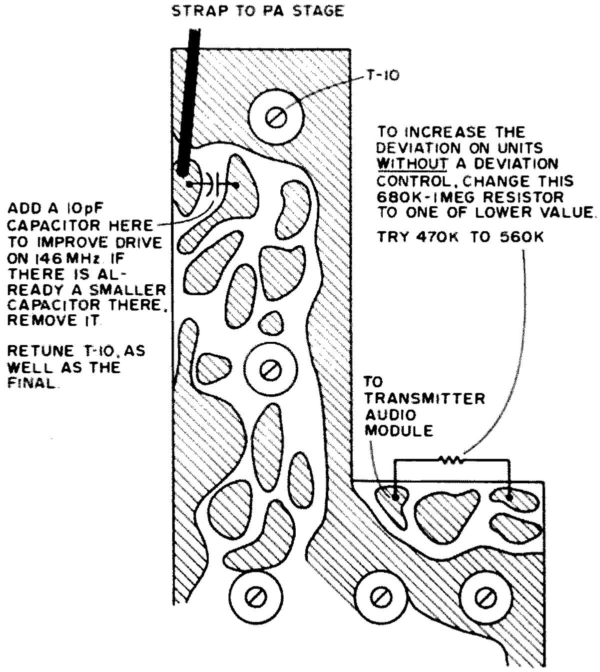

Fig. 3. Transmitter main board.

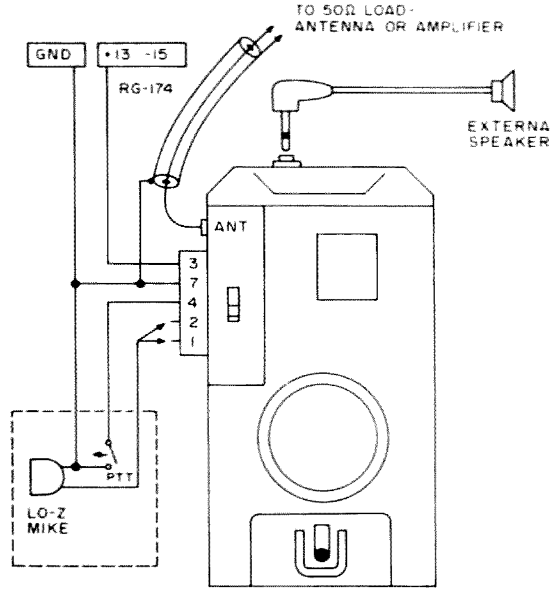

Fig. 4. External connections diagram.

For external power you can use a 13-15V battery or a suitable ac supply.

Conclusion

I hope that this has helped answer a few questions as well as assisted pocket mate owners to get the most from their units.

. . . WB4DBB

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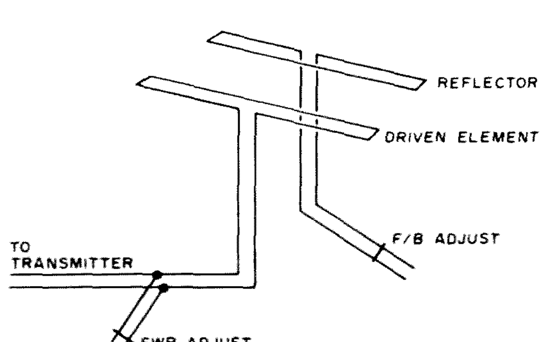
You Can Work 75m DX

With This Simple Beam

Many of us have these fantastic tri-band antennas, either beams or quads. This is a wonderful development with many savings over what we would have to do to have three separate monoband antennas. Of course, there are necessary compromises, but the advantages outweigh these for most of us.

I won't try to add to the beam vs. quad controversy, since the discussion here probably would work on each, although I've never heard of anybody trying this on a quad. Since the tri-band usually gives the choice of 14, 21 or 28 MHz, one is left to his imagination to try to do something on a lower band. Quads and their cousins have been used on the lower bands, but the physical size is somewhat prohibitive. The problem of rotation comes in if the operator contemplates something on 3.5 or 1.8 MHz.

It is possible to suspend a parasitic array between a couple trees or other supports and to have it work quite well. Living at the edge of the country, I didn't have to think too hard about the rotation problem, since at night on 3.5 or 7 MHz, everything happens to the east. So, let's build a parasitic beam!



We will construct two dipole elements making one the driven element and one a reflector. Of course, we could make one the director instead of the reflector but it seems to work out best to make the parasitic a reflector in this 2-element array. From experience I would prefer to construct these as folded dipoles because I have had quite good luck with this type antenna and the later matching procedure may be a bit easier. Furthermore, the folded dipole has much better bandwidth than an ordinary dipole. A 300Ω impedance is no problem to step up from a 75Ω line using a 4:1 balun. You can find plenty of information on lengths as well as construction information in the standard reference books.

We will set up the two elements 90° apart (or if we prefer to use the parasitic as a director, 30° spacing will work well). Feed the driven element in the regular way, matching the impedance with a shorted stub. Don't worry about unity SWR, since further adjustment will be necessary later. If you get it down below 2:1 somewhere it will be fine for right now.

You will need one of these little field intensity meters. A pair would be fine, but make sure they are matched. It is possible to make these with a little antenna, a diode, a few capacitors, and a milliammeter.

Choose two points, along the main axis of the antenna, with the center of the antenna array bisecting the line. Place a stake at each point so you can find the exact point again (or place a field intensity meter at each point). Try to get these points a reasonable distance from the array, free of obstruction to rf fields.

The idea is to adjust the shorting bar on the parasitic element for a maximum front-to-back ratio. You should easily obtain a reading of at least 3:1. Then, of course, adjust the matching bar on the driven element for minimum SWR. You may find some interaction in these adjustments, so tweak them again several times. Remember that you are not using a perfectly-conducting plane earth that the theory books assume, so there will probably be some variation from a perfect cardioid pattern.

. . .WA6CPP

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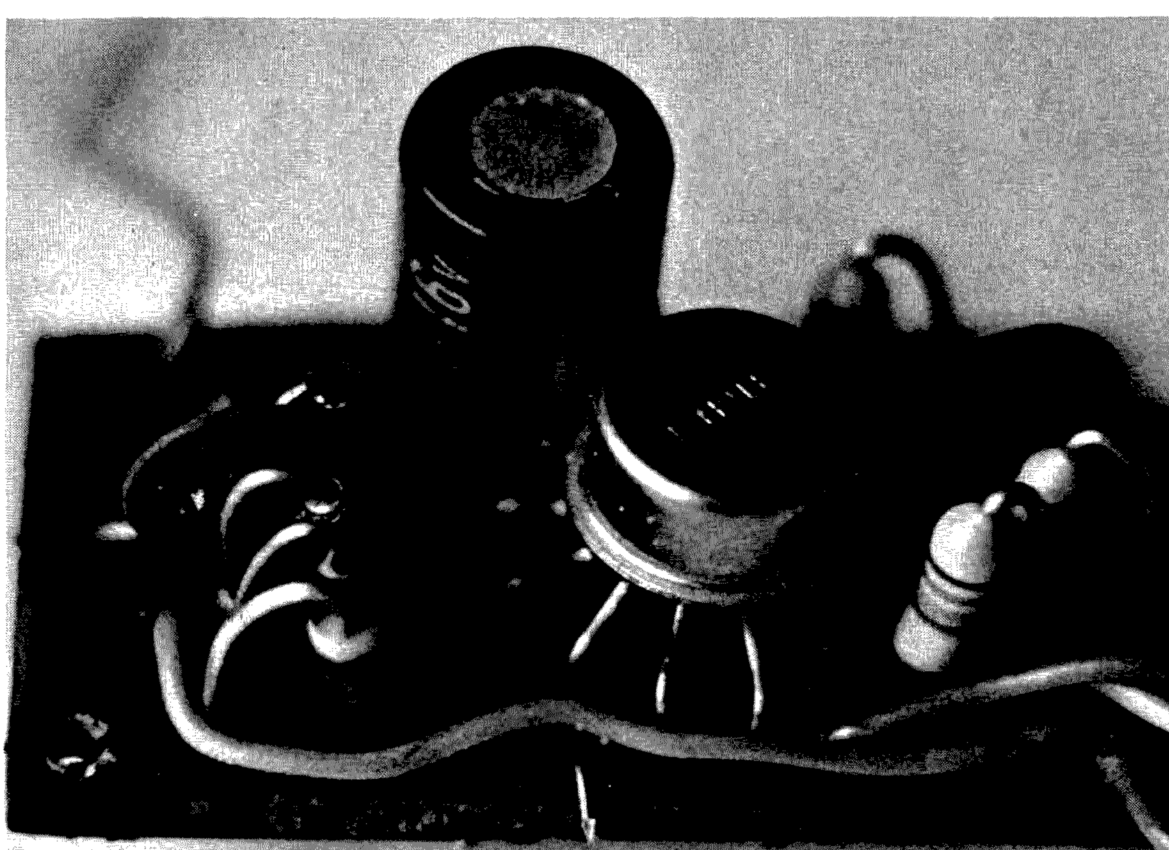
The Postage Stamp Squelcher

ICs ride again.

Need a squelch circuit for an existing receiver which has little space to add anything? If so, you may have looked over published circuits finding they include up to seven discrete transistors, some diodes and a bunch of other components, and given up on



Top view of PC board assembly.

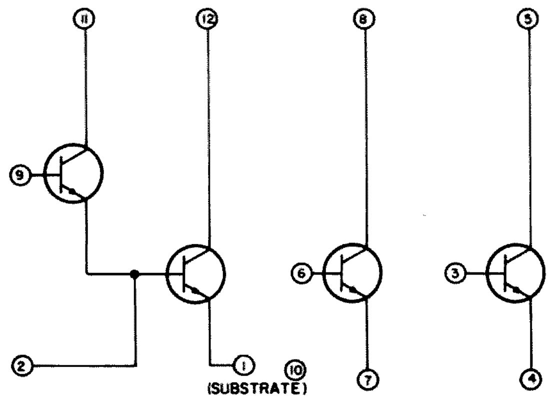


Fig. 1. Internal circuit of RCA type CA 3018 transistor array IC.

squeezing all that onto several square inches of board space.

The effective circuit described takes advantage of the RCA type CA 3018 IC transistor array and a few ¼ Watt resistors and ceramic capacitors, on a PC board measuring 2 cm x 3.5 cm – about the size of a commemorative postage stamp. If you have watchmaker patience it might even be made smaller.

This little squelch adapter will work well with any solid state receiver incorporating discrete transistor audio amplifier and driver stages, be it commercial or home brew. I included it in a small AM/FM/police band radio which lacked squelch for the latter band. Squelch operation is comparable with commercial communication equipment.

Fig. 1 is the basic circuit of the RCA CA 3018 which contains four NPN transistors in a 12 pin, MO-006-AG can. Two of the transistors are internally connected in a Darlington pair, the other two being independent. Only three of the transistors are utilized – the first as a noise amplifier, and the second as a dc bias control for the third, which acts as a switch for af stage voltages in the existing receiver. Other transistor arrays, such as the CA 3086, will function as well with pin variations.

Fig. 2 is the complete squelch circuit. Note that in my version the squelch control, R1, and noise filter components C1 & L are shown external to the PC board. R1 is front panel mounted. C1 & L values provide a high pass roll-off at 6 kHz for the transistor input load of approximately 1k. L is a miniature 15 mH toroid coil.

Fig. 3 shows connection of the squelch adapter to the audio stages of a typical receiver. Note that this circuit has a positive supply voltage ground, common in many Japanese receivers using push-pull PNP output transistors. *For negative ground circuits it will be necessary to reverse the polarity of the electrolytic capacitor C6,* and C4 should be connected to the negative ground.

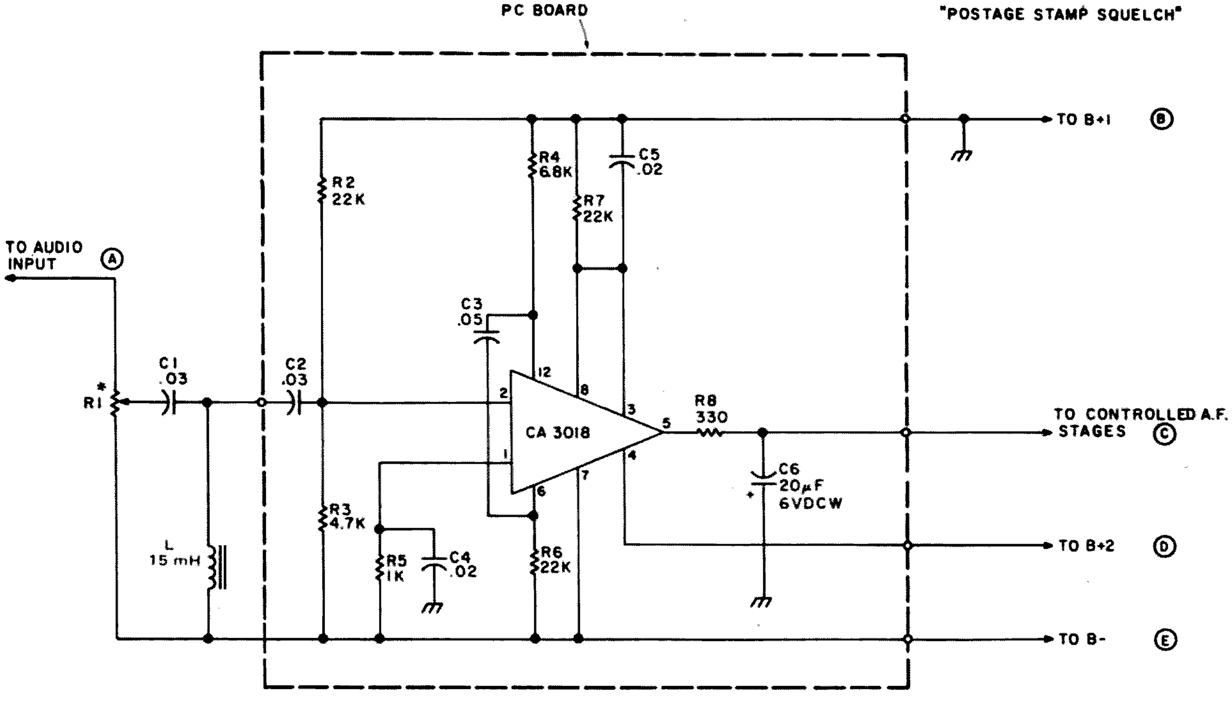


*Fig. 2. Schematic of "Postage Stamp Squelch" module. Note: All capacitors uF; all resistors ¼ W. *See text.*

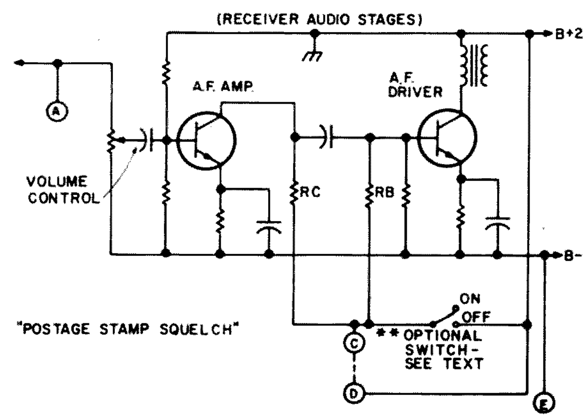


Fig. 3. Connections of squelch to typical receiver audio stages.

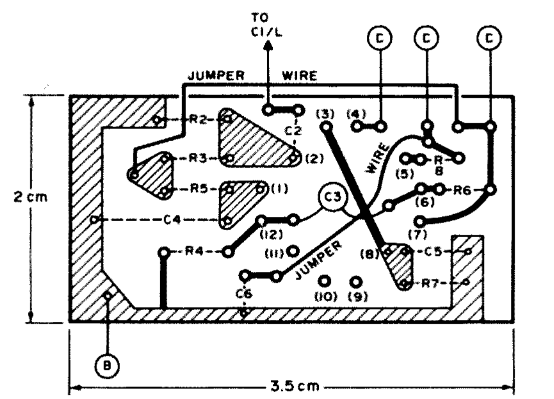


Fig. 4. Squelch module printed circuit board (etched side). Note: CA 3018 pin numbers shown in parentheses; C3 mounted on etched side.

Point A from R1 is connected via a shielded lead to input of the receiver volume control. To avoid loading the audio, R1 should have a value about five times that of the receiver volume control (e.g. for popular 10k volume controls, R1 = 50k).

The B+ connection to the receiver af amplifier collector resistor R_c, and af driver bias resistor R_b, must be broken to allow connection of points C and D shown in Figs. 2 and 3. The series connected switching transistor in the squelch adapter cuts off voltage to R_c and R_b when pure noise is present at the squelch input, muting the receiver. Both collector *and* bias voltages must be switched to obtain effective muting. It is also important that point D be connected to the original supply voltage (denoted as B+2) for the controlled stages, which is usually decoupled from the maximum receiver voltage. Point B (B+1) may be connected to the maximum voltage available, typically that supplying the audio output stages, but not exceeding +12 V dc. As low voltage supplies as 6 V for B+1 and 3.5 V for B+2 have proven adequate.

IC squelch unit installed in commercial FM/police band receiver.

The values of the squelch output filter R8 and C6 (Fig. 2) are somewhat critical, and may require experimentation for individual receivers. R7 should be kept to a low value to minimize voltage drop. C6 must have enough capacity to prevent instability (intermittent noise pumping at threshold setting of R1) – but too large a value will result in excessive delay in squelch action, and a prolonged noise burst.

If no panel space is available for R1, this control may be internally mounted as a preset trimmer. Alternatively R1 may be eliminated and C1 connected to the receiver volume control with a series resistor with a high enough value to just effect complete squelch action. Optionally a miniature SPST switch may be connected as shown in Fig. 2, to cut the squelch on and off from the front panel.

Fig. 4 is the etched side of the 3.5 x 2 cm PC board, with location of components. Pins of the CA 3018 were spread out to allow wider spacing of connecting pads, numbered in parentheses. The ¼ Watt resistors were mounted vertically to minimize space. C3 was mounted on the underside of the board, as were the two jumper wires.

Besides being a worthwhile receiver addition, this application may generate imagination for the miniaturization of many other circuits by utilizing available IC transistor arrays.

... K6JM

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The T-278/U, Surplus Gem

Two Meter Army Boots

Recently the T-278/U VHF transmitter has become available in the surplus outlets at quite reasonable prices. The T-278/U is the transmitter module for the AN/VRC-19 VHF FM transceiver. By today's standards, it is quite bulky to be used on two meter FM. But with a few modifications, the T-278/U can be converted to 2m linear amplifier service. Output power is 50 to 60 Watts PEP when driven with a 5 Watt transverter.

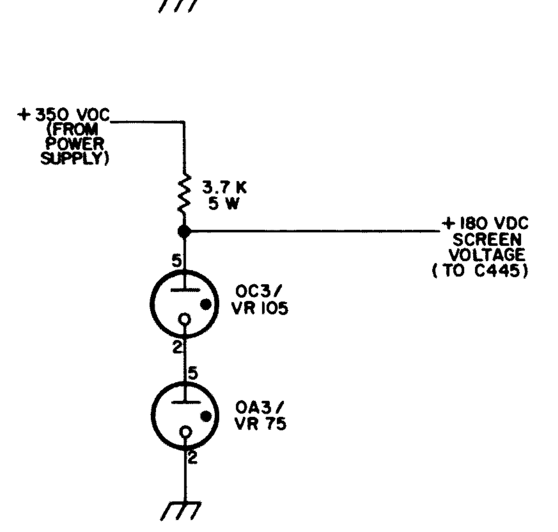
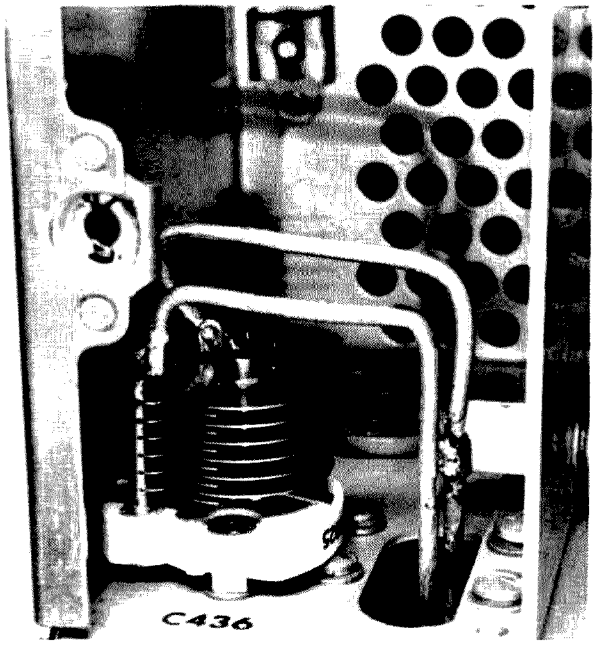


Fig. 1. Screen and control grid voltage regulator circuit for T-217/U modification.

The FM exciter is on a separate chassis within the T-278/U transmitter. The first step is to remove the exciter and add it to your junk box. The rear connector should also be removed unless one has a mating connector and desires to use it for the power supply connections. Otherwise, another plug and connector may be used or the power supply leads may simply be cabled up and connected directly to the power supply as I have done. The area vacated by the exciter is now used for the grid and screen regulators.

The schematic of the T-278/U less the exciter is on the bottom plate of the transmitter. The 2E24 driver tube is removed, as well as L408, the driver plate choke. The plate end of the driver tank coil (L409) is then bent parallel to the other end of the coil and grounded at the driver plate tuning capacitor (C436) as shown in the photo. This coil is then tapped up from ground at a point just before the coil begins to run parallel to the final grid coil. The tap is connected to a coax connector mounted on the side of the box as shown in the photo. Make this connection short and direct. A hole in the side cover will have to be made to clear the coax connector.

The final amplifier 2E24 tubes are replaced with 6146 tubes. The higher inter-



Detail of driver tank coil (L409) after modification.

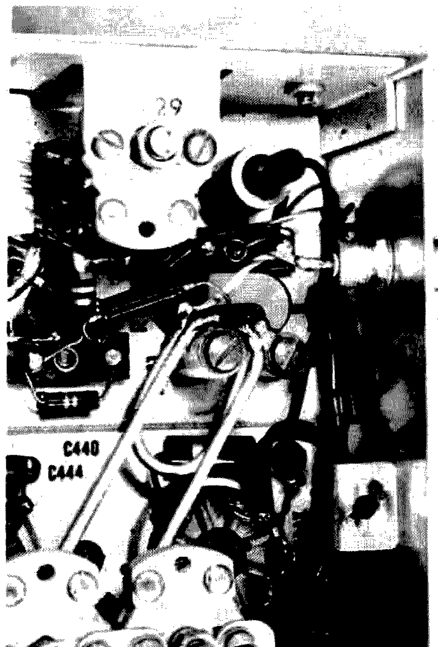
electrode capacitance of the 6146 enables the tank circuits to tune down to 144 MHz from their designed range of 152 to 174 MHz. The filament circuit to the 6146 tube sockets may have to be rewired for 6.3 V ac depending on whether your transmitter is the 6, 12 or 24 volt version. This can easily be determined by checking the schematic diagram printed on the bottom cover plate of the transmitter. Remove R444 and R443, the 33k/1 W series screen resistors, and replace the connection with a wire jumper. The grid tuning capacitors (C437 and C439) may require small padding capacitors to reach 144 MHz. Mine didn't, but the tuning peak was very close to maximum capacitance.

All wiring below the bottom chassis should be removed except the output filter and the coax cable going to it. This makes room for the regulator circuits. My power supply contained no regulated voltages for the grids and screens. Therefore, the circuit shown in Fig. 1 was installed in the rear of the chassis. The series dropping resistors will have to be different values if your supply voltages are other than those shown.

The coaxial relay on the chassis may be used as the TR relay as it is connected (provided the proper coil voltage is applied), or it may be removed and the output taken directly from the filter, or it may be simply jammed closed and the output taken from J412 (which is a type BNC connector).

Tune up is simple. Connect a suitable dummy load and apply power. Set the Tune/Operate switch to Tune and key the transmitter without drive. There should be no signs of instability. Plate current may be monitored with a voltmeter connected across the Plate Current tip jacks on the front. The reading will be 0.01 volt per milliampere of plate current (i.e., a 1.0 volt reading equals 100 mA of plate current). With no drive, there should be no plate current in Tune position and about 10 mA in the Operate position.

Next apply drive and peak the Driver Plate Tune (actually now an input tuning) and the Final Grid Tune while monitoring the plate current and/or the final grid current. An rf output indicator is very helpful if one is available for initial tune-up. Set the output coupling loop at about its midpoint, and adjust the Final Plate Tune for a dip in the plate current. Switch to the Operate position and proceed to dip the plate and load with the Output Coupling and Antenna Tuning controls. Continue until the plate current reaches about 200 mA (2 volts on the voltmeter). Then go back and touch up the other adjustments. The balance between the two tubes may be checked with



Detail of final amplifier grid tuning and rf input connector.

a voltmeter in the jacks labeled "BAL." Balance may be achieved by "tweaking" the grid tuning capacitors or, in extreme cases, by selecting tubes.

There are several nice features about this amplifier besides the low cost and ease of conversion. It is an ideal way for the newcomer on 2 meter SSB to generate modest power with a minimum of fuss and problems. The final tank circuit tunes the 2 meter band nicely and is of good quality. The output filter also helps to eliminate TVI problems.

This amplifier has been in use at KØDAS for about 1 year now and has performed very well. I drive it with a home brew transverter which has a 6360 in the output stage. It has performed very reliably and receives very good reports on the quality of the 2 meter SSB signal. I have used it for tropo and aurora work, but it is also ideally suited for OSCAR work. Best DX on tropo is 650 miles and 940 miles on aurora when I worked K2RTH, Long Island, New York, with 59A signal reports on both ends!

. . . KØDAS

73 Magazine Staff

Disaster in Honduras

In September, 1974, Honduras was jolted by a vicious lady named Fifi. Females of any nature, hurricane or otherwise, scorned or not, seldom have the fury brought by this unwelcome visitor. Her calling card? Thousands dead and homeless and nearly 20,000 square miles left without communications.

Needless to say, Fifi's arrival did not go unnoticed – or unanswered. Within hours, Rafael Tavares HR2RT, in La Lima, became the first radio amateur to be heard from the stricken area, and his description of the holocaust succeeded in alerting the rest of the world to the magnitude of the tragedy. Among the first to take notice – and to respond – was SIRA, the International Society of Radio Amateurs.

Left to right: Mario Paz HR1RP, Rafael Estevez WA4ZZG, Jack Goodwin VE3DPQ/W4, Jonathan Roussel HR1RT, Daniel Gomez YV5DWB/W4, Major Edmundo Alcerro (Liaison Officer), Alejandro Talbott HR1ALT, and Larry Lytle YN1LL/W4. Carlos DeFelipe LU2DZ/W4, who also flew down to Tegucigalpa, is not in the picture.

Checking and packing equipment for shipment to HRØCOPEN in Tegucigalpa. Bottom, left to right: Walkyria Picos (SWL), Larry Lytle. Top, left to right: Marta Estevez YN1ME, Rafael Estevez, Daniel Gomez.

Rafael M. Estevez WA4ZZG, SIRA's president and emergency coordinator, taped Tavares' entire transmission and played it back on a commercial station in Miami. Despite man-made as well as atmospheric interference, Friday, September 20, found members of SIRA guarding three emergency frequencies (14.205 kHz, 7.155 kHz, and

Daniel Gomez and Larry Lytle, while operating HRØSIRA/HRØCOPEN in Tegucigalpa, Honduras. Photo courtesy of the Honduran Army.

In contact (2m FM) with a light plane over the stricken area are (left to right) Danilo Fuentes (Honduran Civil Air Patrol), Alejandro Talbott, and Rafael Estevez.

3.805 kHz) and relaying many messages to coordinate disaster relief and allay the fears of friends and relatives in the United States.

The experience gained by SIRA in December, 1972, when an earthquake destroyed Managua, Nicaragua, stood them in good stead. At that time, with the Latin Chamber of Commerce of Miami, radio station WFAB, and other civic organizations, they organized a radio marathon which produced tremendous contributions of food, money and clothing. Therefore, when they received a call from Alejandro "Alex" Talbott HR1ALT in Tegucigalpa pleading for immediate aid in the way of antennas, radio equipment, food and medicine, they were able to quickly set up another radio marathon called "Operation People to People" through radio station WQBA. Around the clock, they solicited and raised approximately $26,500 in cash and over 15 tons of food, medicine, clothing, tents and other emergency items. Not content with this effort, they then solicited the coopera-

tion of TAN Airlines, to transport the fruits of their labors to the disaster area. Finally, they sent a group of volunteers with various items of radio equipment and accessories necessary for emergency communications, which they installed and operated from station HRØSIRA in Honduras.

WQBA's radio marathon, which terminated Sunday, September 22, continued to collect donations of money, food, medicine and clothing, and the total amount realized was in excess of $43,000 cash and 500 tons of supplies (worth $2 million).

To be sure, the havoc wrought by Fifi will take a long time to untangle. The silver lining in her stormy clouds, though, was another demonstration by hams of invaluable emergency communications. And while dozens of amateurs from as many countries contributed immeasurably to the relief operation's success, the final plaudits must go to SIRA, one group which puts its time and effort where its motto is – "We foster brotherhood and good will."

...STAFF

HAM HELP

Helpers: Times are tough all over, but remember when you were just starting out? Brighten one of the following's ham day by getting in touch and lending a hand. Preserve the race!

John R. Stannard
Box 73
Gorman CA 93534
(805) 248-6262

Ed Wenzinger, Sr.
3106 Chapel View Drive
Beltsville MD 20705
(301) 572-5433

Dick Hart
228 Bristol Ferry Road
Portsmouth RI 02871
(401) 683-1565

Charles F. Super, Jr.
1106 Anchor Street
Philadelphia PA 19124

Tommy J. Grier
2751 Gill Rd.
Mobile AL 36605
Tel. 478-0130

Helpees: Don't be bashful. Drop a postcard to 73, Ham Help, Peterborough, NH 03458.

73 MAGAZINE'S GUIDE TO

Manufacturer	SBE	Tempo	Motorola	Heath	Yaesu
Model	SB-144	CL-146	Metrum II	HW-202	FT-224
Latest Price *See Mfr's specs	–	$299.00	$399.95*	$179.95	$249.00
Number of Channels	12	12	12	6	24
Size – height (inches)	2-3/8"	2.36"	2-3/4"	2-3/4"	2-3/4"
width (inches)	6-11/16"	5.9"	11"	8-1/4"	7"
depth (inches)	9-1/16"	7.66"	9-1/4"	9-7/8"	8-1/2"
Weight in lbs.	4.6	4-1/2	8	10	5.5
Power Output Hi/Low	10	15/5	25/1&10/1	10W	10/1
Rx – i-f Frequency	10.7	10.7	21.0 MHz/ 455 kHz	10.7/455	10.7 MHz
Rx – Crystal Formula (÷3 or ÷9?)	3	3	3	3	9
Crystal Capacity/Resistance	P.20	10/20	5	40Ω	28/15
Crystal Holder (HC25U?)	Yes	Yes	Yes	Yes	Yes
Padder for Receive Xtal?	No	Yes	Yes	Yes	Yes
Xtal Formula (x 12?)	x24	÷12(tx)	–	x24	x8(tx)
Crystal Capacity pF/Resistance Ohms	P.66	30/15	–	23/40	25/15
Type Channel Selector Switch	Rot.	Rot.	Rot.	P B	Rot.
Ac Input (120/240?)	No	No	No	No	No
Input Power Rec. Sq.: 12 V @ (**13.8V @)	–	.25A	.3	.2	–
Receive	.35A	.35A	–	–	0.45A
Xmt – Hi Power	2.4A	2.5A	7.5A@25W	2.2A	2.2A
Lo Power	–	.8A	3.5A@10W	–	0.7A
Mismatch Protection	Yes	Yes	Yes	Yes	Yes
Antenna Connector Type	UHF	UHF	UHF	Phono	UHF
S-Meter?	Yes	Yes	No	Yes	Yes
Power Output Meter?	Yes	Yes	No	Rel	Yes
Battery Meter?	–	No	No	No	Yes
Deviation Meter?	–	No	No	No	No
Headphone Jack?	–	No	No	No	No
Type Jack for Headphone	–	–	–	–	–
SWR Indicator?	–	No	No	–	No
Synthesizer?	–	No	No	–	No
Synthesizer kHz Steps	–	–	–	–	–
Synthesizer Repeater Offset (±600 kHz/other)	–	–	–	–	–
Accessory Plug?	No	Yes	No	No	No

2 meter FM TRANSCEIVERS

Yaesu	Ham Import Sales	Satan	Intern	Audioland	Regency	Regency	Regency
200R	KDK-144	Brimstone 144	ITC Multi-2000	Beltek W5570	HR-2B	HR-212	HR-2ms
$449.00	$399.00	$650.00	$695.00	$279.00	$229.00	$259.00	$319.00
Syn	Syn	1598tx & 1598rx	Syn	22	12	12	8
2"	2"	3-1/4"	3-1/2"	2-3/8"	2-1/4"	4"	4"
8-1/2"	6-1/2"	10-1/4"	13"	6-11/16"	5-1/2"	10"	10"
9"	7-3/4"	9-1/2"	11"	10"	7-1/2"	8-1/2"	8-1/2"
6.6	6.6	8	14	5.9	5-1/2	–	–
10/1	10W	25W	10/1	10/1	15-1	20W	20W
10.7	Syn	10.7 MHz	16.9 MHz/ 455 kHz	–	10.7/455	10.7/455	10.7/455
–	–	–	3	–	3	3	3
–	–	–	32/40	–	S-35	S-35	S-35
–	–	–	Yes	Yes	Yes	Yes	Yes
–	–	–	Yes	Yes	No	No	No
–	–	–	same as rcvr	–	18	24	24
–	–	–	–	–	32/35	32/35	32/35
Dual concentric	3 rotary switches	Rotary decimal	3 Rot.	Rot.	Rot.	Rot.	PB
–	No	No	120 V ac	No	–	–	–
–	1.0A	1A	1.7A	–	**.18A	**.18A	**.18A
0.45A	1.2A	1.2A	1.8A	.4A	**.80A	**.8A	**.8A
2.2A	3.0A	5A	4.0A	2.5A	**3.0A	**4A	**4A
–	–	–	2.7A	.5A	–	–	–
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UHF	UHF	UHF	UHF	UHF	UHF	UHF	UHF
Yes	Yes	Yes	Yes	Yes	No	No	No
Yes	Yes	Yes	Yes	Yes(S-m)	No	No	No
No	No	No	N/R	N/A	No	No	No
No	No	No	Yes	No	No	No	No
No	No	No	Yes	No	No	No	No
–	No	–	Mini	Mini	–	–	–
No	–	No	No	No	No	No	No
Yes	Yes	Yes	Yes	No	No	–	No
10 kHz	10	5 kHz	10 kHz= RIT/VXO	N/A	–	–	No
automatic ±600 kHz	yes 600±	independent any offset	=600 kHz	N/A	–	–	–
No	Yes	Yes	Yes	Yes	No	–	–

73 MAGAZINE'S GUIDE TO

Manufacturer	Drake	Drake	Standard	Clegg	Clegg
Model	TR-22C	TR-72	826-MA	27B	FM-DX
Latest Price *See Mfr's specs	$229.95	$320.00	$398.00	$479.95	$589.95
Number of Channels	12	23	12	Syn	Syn
Size – height (inches)	7½"	2-3/8"	2-1/2"	3-1/2"	3-1/8"
width (inches)	5-3/8"	7-1/16"	6-7/8"	7-3/8"	7"
depth (inches)	2-5/16"	9-7/16"	9"	9-1/4"	10-1/2"
Weight in lbs.	3-3/4	5.5	4	4	5-1/2
Power Output Hi/Low	1W	10/1W	10/1	25W	35/1
Rx – i-f Frequency	10.7/455	10.7/455	11.7/455	4.5/455	10.7
Rx – Crystal Formula (÷3 or ÷9?)	3	3	9	–	–
Crystal Capacity/Resistance	32	32	80	–	–
Crystal Holder (HC25U?)	Yes	Yes	Yes	–	–
Padder for Receive Xtal?	No	No	Yes	–	–
Xtal Formula (x 12?)	x12	x12	18	–	–
Crystal Capacity pF/Resistance Ohms	36	36	24	–	–
Type Channel Selector Switch	Rot.	Rot.	Rot.	N/A	3 digit decade + 0/5 kHz
Ac Input (120/240?)	12 V dc	12 V dc only	option.	No	No
Input Power Rec. Sq.: 12 V @ (**13.8V @)	45 mA	.4A	.35A	.2A	1.0A
Receive	–	–	1.2A	.4A	1.2A
Xmt – Hi Power	.45	2.7A	2.4A	6.5A	9.5A
Lo Power	–	1.2A	1.5A	–	3.5A
Mismatch Protection	No	Yes	Yes	Yes	Yes
Antenna Connector Type	UHF	UHF	UHF	UHF	UHF
S-Meter?	Yes	Yes	Yes	No	Yes
Power Output Meter?	Yes	Yes	Yes	Yes	Yes
Battery Meter?	Yes	No	Yes	No	No
Deviation Meter?	No	No	No	–	No
Headphone Jack?	No	No	Yes	Yes	Yes
Type Jack for Headphone	No	No	Mini	Phono	Phono
SWR Indicator?	No	No	Yes	No	No
Synthesizer?	No	No	No	Yes	Yes
Synthesizer kHz Steps	No	No	–	Cont.	5 kHz
Synthesizer Repeater Offset (±600 kHz/other)	No	No	–	Inde-pendent	Yes plus 3 optional
Accessory Plug	No	Yes	Yes	Ext. Spkr.	Yes

2 meter FM TRANSCEIVERS

Emergency Beacon	Genave	Genave	Genave	Icom	Icom	Icom	Spectrum
EBC-144 Jr.	GTX-2	GTX-10	GTX-200	IC-230	IC-21A	IC-22	560
$599.00	$189.95	$169.95	$199.95	$489.00	N/A	$249.95	$180.00
Syn	10	10	10	Syn	24	22	6
2-3/4"	2-1/2"	2-1/2"	2-1/2"	2-1/4"	4-3/8"	2-1/4"	2-1/4"
6-1/2"	6-1/2"	6-1/2"	6-1/2"	6-1/8"	9"	6-1/8"	6"
9"	10-3/4"	10-3/4"	10-3/4"	8-1/2"	11"	8"	8"
5	3	3	3	5-1/2	14-1/2	3-3/4	N/A
20W	30W	10W	30W	10W	10/1	10/1	5W
10.7	13.1	13.1	13.1	10.7/455	10.7/455	10.7/455	10.7
–	3	3	3	–	9	9	÷3
–	39/30	39/30	39/30	–	20/15	20/15	32
–	Yes	Yes	Yes	–	Yes	Yes	Yes
–	No	No	No	–	Yes	Yes	Yes
–	x12	x12	x12	–	8	8	x12
–	20/30	20/30	20/30	–	20/15	20/15	36
TW	PB	Rot.	Rot.	Rot.	Rot.	Rot.	Rot.
No	No	No	No	No	Yes	No	No
1.0A	.15A	.15A	.15A	.2A	.2	180	90mA
1.5A	.25A	.25A	.25A	.4A	.4	350	–
7.0A	6A	2A	6A	2.4A	2.1	2.0	.9A
–	2A	–	2A	N/A	1.2	.9	–
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
UHF	UHF	UHF	UHF	UHF	UHF	UHF	UHF
Yes	No	No	No	Yes	Yes	Yes	No
Yes-	No	No	No	Yes	Yes	Yes	No
No	No	No	No	No	No	No	Yes(LED)
No	No	No	No	No	Yes	No	No
Yes	No	No	No	No	Yes	No	No
Mini	1/4"	–	1/4"	Mini	No	No	No
–	No	No	No	No	Yes	No	No
Yes	No	No	No	Yes	No	No	No
5 kHz	–	–	–	30	No	No	No
any offsets	–	–	–	Yes±6	No	No	No
No	No	No	No	Yes	No	No	No

Which 2m Rig For YOU?

Amateurs are forever calling up 73 Magazine and asking what FM transceiver they should buy. Is this one any good? Is that one any good? The answers sometimes are not comfortably clear cut, and often reduce to another simple question: What do you want in an FM rig?

You have to decide whether you can get along with six channels . . . with twelve . . . or, perhaps, if it is worth it to get all the channels – which means a synthesized rig. Do you really need more than 24 channels? Will you want a combination walkie-talkie and mobile rig? Or are you looking for a rig just to use at home? Do you want to be able to use the same rig for FM and for working sideband . . . perhaps via the Oscar satellites? How important is ac power for you? How much do you want to spend?

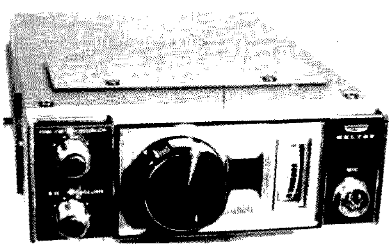
The last question answers many of the others, for it is a good general rule that the more doodads you want on your rig, the more it is going to cost. Some amateurs figure that the actual cost of a rig is about half the price they pay, since they will probably be able to sell it for about half price in a couple of years, when they move on to a newer rig. At least it could be worth half price if it is still in good shape – some amateurs have a dustbin complex and turn any piece of new gear into WWII surplus in a week.

With few exceptions the rigs listed have been tested at 73 HQ. (No tests have yet been possible on the Brimstone, and only a prototype of the EBC Jr has been wrung out.) The new Clegg FMDX is not yet available, nor the KDK – watch for data on these in later issues, as they become available and are checked out.

A word to manufacturers, if there are any gripes on the guide: We really tried to make it accurate. It took months to finally wring info and pictures from everyone – and still we had to piece things together from ads or old spec sheets in some cases. If it is this difficult for the 73 staff to round up this data, imagine how impossible it would be for the average reader! The guide may not look like a big deal, but it took weeks of work for five people and you-wouldn't-believe-how-many phone calls. Enjoy . . . please.

AUDIOLAND

Audioland
36633 S. Gratiot
Mt. Clemens MI 48043



BELTEK-W5570

- 22 channels
- Output power of 10 Watts or 1 Watt
- S-meter and power output meter
- Dimensions: 2.38" H x 6.66" W x 10" D
- Weight: 5.9 lbs
- **Price: $279.00**

CLEGG

Clegg Division,
International Signal &
Control Corp.
3050 Hempland Road
Lancaster PA 17601

27B

- Synthesized channels
- Power output of 25 Watts
- Full independent transmit
- Receive coverage 146-148 MHz with 1 kHz resolution
- No repeater offset or channel spacing limitations
- Discriminator meter
- Mobile mount with locking device
- Dimensions: 3.50" H x 7.38" W x 9.25" D
- Weight: 4 lbs
- **Price: $479.95**

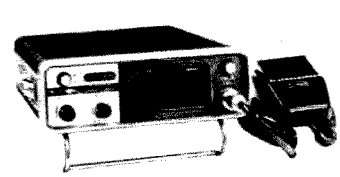
FM-DX

- Synthesized channels
- Power output of 35 Watts or 1 Watt
- Frequency coverage: 143.5 – 148.5 MHz
- Intermod atten: >66 dB
- LED numeric frequency display (6 digits)
- Modular construction

- Dimensions: 3.13" H x 7" W x 10.5" D
- Weight: 5.5 lbs
- **Price: $589.95**

DRAKE

R. L. Drake Company
540 Richard Street
Miamisburg OH 45342

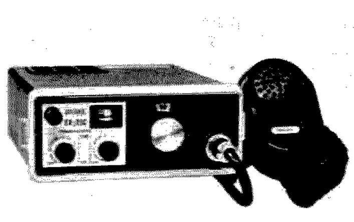


TR-72

- 23 channels, 2 supplied
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 through 148 MHz
- Dimensions: 2-3/8" H x 7-1/16" W x 9-7/16" D
- Weight: 5.5 lbs
- **Price: $320.00** *(Including Dynamic microphone, DC power cord, four position mobile mounting bracket, desk mount stand, microphone, hanger, auxiliary connector plug and external speaker plug.)*
- *Accessories: AC-10 power supply @ $44.00*

TR-22C

- 12 channels, 2 supplied
- Output power of 1 Watt minimum
- Frequency range: 144 through 148 MHz
- Monolithic crystal filter in i-f for superior adjacent-channel selectivity
- Improved microphone
- Dimensions: 7.5" H x 5.38" W x 2.31" D



- **Price: $229.95** *(Including mike, over-the-shoulder carrying case, 120 V ac and 12 V dc cords, 10 ni-cad batteries, and speaker/headphone plug.)*
- *Accessories: AC-10 power supply — $44.00, AA-10 10W amplifier — $49.95*

EMERGENCY BEACON

Emergency Beacon Corp.
13 K River Street
New Rochelle NY 10801

EBC-144 Jr.

- Synthesized channels
- Output power of 20 Watts
- Frequency range: 143.5 MHz to 148.5 MHz in 5 kHz increments
- Synthesizer flexibility that offers a choice of 600 kHz offsets up or down, automatically selected for standard channel spacing

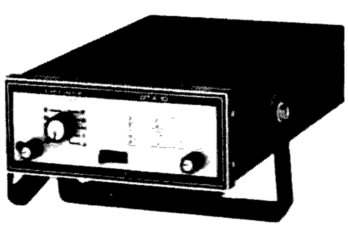
- Reverse simplex and frequency split allowing totally independent receive and transmit frequencies
- Dimensions: 2.75" H x 6.50" W x 19" D
- Weight: 5 lbs
- **Price: $599.00**

GENAVE

General Aviation Electronics, Inc.
4141 Kingman Drive
Indianapolis IN 46226

GTX-10

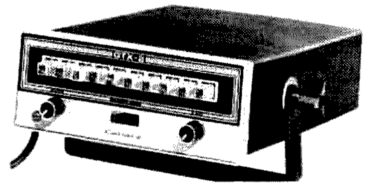
- 10 channels
- Output power of 10 Watts
- Simple conversion to 30 Watt output
- Easily cross-wired for duplex crystal operation
- Transmit indicator light
- Perfect for portable operation with HamPak



- Dimensions: 2.5" H x 6.5" W x 10.75" D
- Weight: 3 lbs
- **Price: $169.95**
- *Accessories: Touch Tone Encoder — $59.95, Subaudible Tone Encoder — $19.95, AC Power Supply $49.95, Battery and Antenna Package (less batteries) $29.95, Battery and Antenna Package with 60 Watt hour rechargeable battery — $124.95*

GTX-2

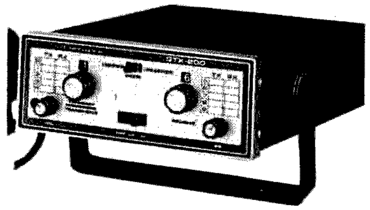
- 10 channels
- Output power of 30 Watts
- Push-button channel selection
- Rear panel external speaker jack
- Backlighted for night operation
- Transmit indicator light
- Perfect for mobile operation



- Dimensions: 2.5" H x 6.5" W x 10.75" D
- Weight: 3 lbs
- **Price: $189.95**
- *Accessories: Same as those available with GTX-10*

GTX-200

- 10 channels
- Output power of 30 Watts
- Separate controls for independent transmit and receive frequency selection
- Switch for lock-in of pre-selected frequency pairs allows one-knob operation
- Rear panel external speaker jack
- Backlighted for night operation



- Dimensions: 2.5" H x 6.5" W x 10.75" D
- Weight: 3 lbs
- **Price: $199.95**
- *Accessories: Same as those available for GTX-10*

HAM IMPORT SALES

Ham Import Sales
P.O. Box 1009
Blaine WA 98230

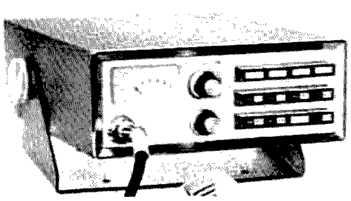
KDK-144

- Synchronized channels

- Output power of 10 Watts
- S-meter and power output meter
- LED readout
- 1 memory channel set at 146.52
- Accessory plug for tone access
- Dimensions: 2" H x 6.50" W x 7.75" D
- Weight: 6.6 lbs
- **Price $399.00** *(Including microphone, mounting bracket, and power cord)*

HEATH

Heath Company
Benton Harbor MI 49022



HW-202

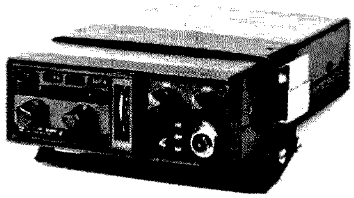
- 6 channels
- Output power of 10 Watts
- All plug-in crystal channels
- Dimensions: 2.75" H x 8.25" W x 9.88" D
- Weight: 10 lbs
- **Price: $179.95(in kit form only)**
- *Accessories: AC power supply — $29.95, Tone Burst Encoder — $24.95, Mobile Antenna — $19.95, Fixed Station Antenna — $17.95, VHF wattmeter — $34.95, PWR Amplifier — $69.95*

ICOM

ICOM
Division of ACS, Inc.
Box 331
Richardson TX 75080

IC-230

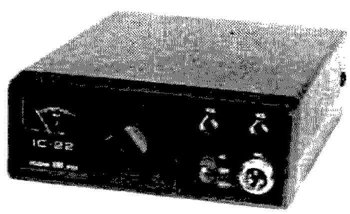
- Synthesized channels
- Output power of 10 Watts
- Frequency coverage: 146 — 148 MHz
- Quick disconnect mobile mount
- Modular construction



- Dimensions: 2.25" H x 6.13" W x 8.50" D
- Weight: 5.5 lbs
- **Price: $489.00**

IC-22

- 22 channels mobile
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 to 148 MHz



- 5 channels supplied
- Input strength and output power indication on a meter
- No relays to wear
- COR light shows receiver signal without audio being on
- Dimensions: 2.25" H x 6.13" W x 3.75" D
- Weight: 3.75 lbs
- **Price: $249.95**

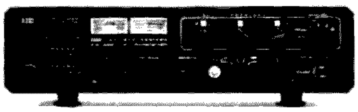
IC-21A

- 24 channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144.00 to 148.00 MHz
- Discriminator meter — S-meter/power output meter
- Netting switch for calibration

- Dimensions: 4.38" H x 9" W x 11" D
- Weight: 14.5 lbs
- **Price: N/A**

INTERNATIONAL

International Telecommunications Corporation
P.O. Box 4235
Torrance CA 90510

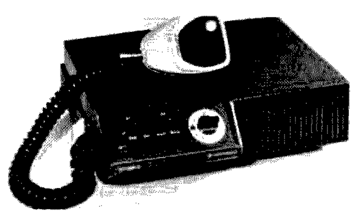


ITC Multi-2000

- Synthesized channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 — 148 MHz possible with RIT and VXO continuous
- Output power adjustable with internal controls from 0 W — 15 W, all modes
- Multi-mode 2m transceiver: CW/SSB/NBFM/WBFM
- Dimensions: 3.5" H x 13" W x 11" D
- Weight: 14 lbs
- **Price: $695.00**

MOTOROLA

Motorola Corporation
Amateur Radio Division
Phoenix AZ

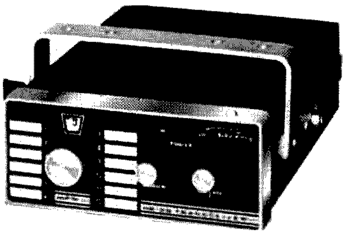


Metrum II

- 12 channels
- Output power of either 25 W/1 W or 10 W/1 W
- Reverse polarity protection
- Provision for external speaker
- Only one crystal required per channel
- Crystals supplied for 146.94
- Reversible control panel and mounting tray for ease of installation in various positions
- Dimensions: 2.75" H x 11" W x 9.25" D
- Weight: 8 lbs
- **Price: 25 Watt — $499.95, 10 Watt — $399.95**

REGENCY

Regency Electronics, Inc.
7707 Records Street
Indianapolis IN 46226

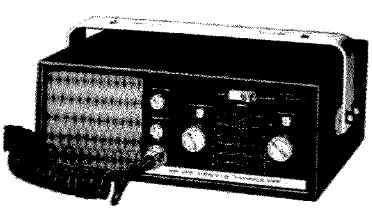


HR-2B

- 12 channels
- Output power of 15 Watts or 1 Watt
- Frequency range: 144 – 148 MHz
- All plug-in crystal channels
- Audio output of 3 Watts
- Dimensions: 2.25" H x 5.50" W x 7.50" D
- Weight: 5.5 lbs
- **Price: $229.00** *(Including plug in ceramic mike, mounting bracket and transmit and receive crystals for 146.94 MHz)*

HR-212

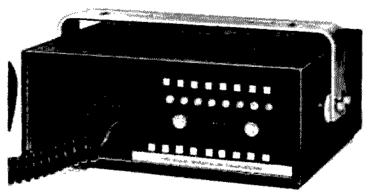
- 12 channels
- Output power of 20 Watts
- Frequency range: 144 – 148 MHz



- Mode switch enables pre-determined or independent paired frequency transmit and receive operation
- Dimensions: 4" H x 10" W x 8.50" D
- **Price: $259.00** *(Including plug-in ceramic mike, mounting bracket and factory installed transmit and receive crystals for 146.94 MHz)*

HR-2MS

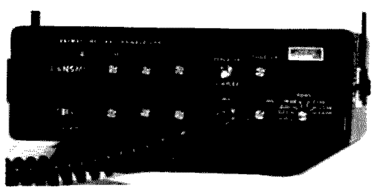
- 8 channels
- Output power of 20 Watts
- Frequency range: 144 – 148 MHz
- Receiver automatically scans 8 channels for active signals



- Readout lights detail search
- Transcan locks on and hears entire transmission
- Push buttons for each of the 8 transmit channels
- Dimensions: 4" H x 10" W x 8.5" D
- **Price: $319.00**

SATAN

Satan Electronics, Inc.
R.R. 3 Box 38A
Salina KS 67401



Brimstone 144

- All channels
- Output power of 25 Watts
- Frequency range: 143.00 to 149.99 MHz in increments of 5 kHz
- Backlit front panel
- Durable foam vinyl covering on cabinet
- All solid-state with plug in modules
- Dimensions: 3.25" H x 10.25" W x 9.50" D
- Weight: 8 lbs
- **Price: $650.00**
- *Accessories: Touch Tone – $18.95, sub-audible PL continuous tone – $18.95, dial tone – $18.95, Tone Burst – $28.50, 142 MHz coverage – $15.00*

SBE

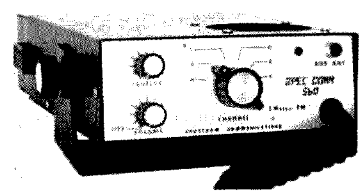
SBE Linear Systems, Inc.
220 Airport Blvd.
Watsonville CA 95076

SB-144

- 12 channels
- Output power of 10 Watts
- All plug in crystal channels
- S-meter and power output meter
- Dimensions: 2.38" H x 6.69" W x 9.06" D
- Weight: 4.6 lbs
- Price: N/A

SPECTRUM

Spectrum Communications
Box 140
Worcester PA 19490



MODEL 560

- 6 channels
- Output power of 5 Watts
- Frequency range: 146 to 148 MHz
- Built-in 3" speaker
- Front panel LED pilot light doubles as accurate battery voltage indicator
- Front and rear panel antenna jacks
- Dimensions: 2.25" H x 6" W x 8" D
- **Price: $180.00**
- *Accessories: 120 V P.S. – $45.00, 25 W Amp/preamp – $89.00, Battery and charger – $69.00, Mounting Bracket – $8.00*

STANDARD

Standard Communications
639 North Marine Avenue
Wilmington CA 90744

826 MA

- 12 channel
- Output power of 10 Watts or 1 Watt
- Frequency range: 143 to 149 MHz
- Completely solid-state
- Enclosed in a splash-proof, weather-resistant case
- Built-in loudspeaker, microphone, line filter, universal mounting bracket and

factory installed crystals for four popular channels
- Dimensions: 2.50" H x 6.88" W x 9" D
- Weight: 4 lbs.
- **Price: $398.00**
- *Accessories: AC supply — $56.00, external speaker — $17.00, portable battery pack — $34.00, tone squelch board — $81.50, solid-state tone squelch board — $95.50, replacement microphone connector — $3.00, replacement dc power cable — $1.25, transceiver mounting bracket for mobile — $3.00*

TEMPO

Henry Radio
11240 West Olympic Blvd.
Los Angeles CA 90064

CL-146

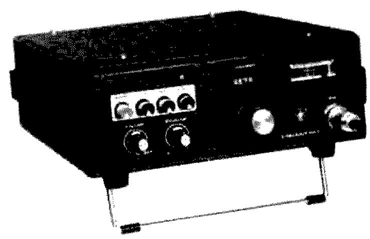
- 12 channels
- Output power of 15 Watts or 5 Watts
- Frequency range: 144 to 148 MHz
- RF output meter, S-meter, receiver detector meter
- Audio output at front panel
- Internal speaker — Dynamic high impedance microphone
- Dimensions: 2.36" H x 5.90" W x 7.66" D
- Weight: 4.5 lbs
- **Price: $299.00**

YAESU

Yaesu Musen USA, Inc.
7625 East Rosecrans Avenue
Paramount CA 90723

FT-224

- 24 channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 to 146 MHz or 146 to 148 MHz
- Discriminator/S-meter
- "Call" or priority channel
- Supplied with 3 channels
- External speaker jack
- Dimensions: 2.75" H x 7.08" W x 8.66" D
- Weight: 5.5 lbs
- **Price: $249.00**



SIGMASIZER-200R

- Synthesized channels
- Output power of 10 Watts or 1 Watt
- Frequency range: 144 to 146 MHz or 146 to 148 MHz
- Priority channel overrides main channel selector
- External speaker jack
- Dimensions: 3.15" H x 8.66" W x 9.05" D
- Weight: 6.6 lbs
- **Price: $449.00**

SOCIAL EVENTS

FRESNO CA
MAY 2-4

The 1975 Pacific Division American Radio Relay League Convention will be held on May 2-4 at the Sheraton Inn in Fresno. Judging from past turnouts we can expect between 500 and 600 registered delegates and 100 to 200 non-registered hams. Rooms are single, $17; double, $20; and suites, $35. Limited number of rooms available – they must be reserved through the convention committee. For more information contact: Berge Bulbulian WB6OSH, Exhibit Chairman, Fresno Amateur Radio Club, Inc., P.O. Box 783, Fresno CA.

SAN DIEGO CA
MAY 2-4

This year's West Coast VHF Conference will be held at the Sheriden Inn on Harbor Island in San Diego on May 2-4, 1975. Tech talks are sked for Sat. 3rd, from about 9 am to 5 pm; prize drawing; Noise Figure contest Sat evening; Antenna measuring contest Sun am Pre-reg is $2.50, hotel accomos are $21 single, $27 dbl. More info will be sent later to those on our mailing list. Those who don't get one should drop a line for info sheet, etc, to Louis N. Anciaux WB6NMT, Spec Comm Sys, 4519 Narragansett Ave, San Diego CA 92107.

CADILLAC MI
MAY 3

The Wexsaukee Radio Club announces their 15th annual Swap-Shop and Eye-Ball that will be held May 3rd in the National Guard Armory in Cadillac, Michigan starting at 9 am. This Swap-Shop is open to all radio amateurs, CBers and anyone interested in radio communications. Lunches will be available at noon and there is lots of free parking. Tickets available at the door. All are invited.

CONNECTICUT QSO PARTY
MAY 3-5

Contest period 2100 GMT May 3 to 0200 GMT May 5. Certificates to highest scorer in each ARRL section or Province and each Connecticut county. Special – Worked All Connecticut Counties certificate. Trophy to highest scoring club entry. For info write Candlewood Amateur Radio Assn., c/o Donald Crosby W1EJM, 10 Royal Rd., Danbury, Conn. 06810.

WESTMINSTER MD
MAY 4

The Potomac Area VHF Society will hold their Annual hamfest on Sunday, May 4, 1975, at the Agricultural Center in Westminster, Maryland between the hours of 9 am to 5 pm. There will be a registration of $3. Talk-in will be on 146.94 & 52. For information contact K3DUA or WA3NZL.

GREENVILLE SC
MAY 4

The Blue Ridge Radio Society's annual Hamfest will be held Sunday, May 4, 1975. Same location as in past years at Cleveland Park in Greenville, South Carolina. Prizes, flea market, bingo. Talk-in on 146.01/61.

ST PETERSBURG FL
MAY 4

The St. Petersburg, Florida, Amateur Radio Club (SPARC) will hold their annual Hamfest at Lake Maggiore Park, Sunday, May 4, 1975. Tables will be available for sales or trading of used and Home brew equipment as well as home-made Arts and Crafts items.

GEORGIA QSO PARTY
MAY 10-12

Starts: 2000 GMT, Saturday, May 10, 1975

Ends: 0200 GMT, Monday, May 12, 1975

The 14th annual Georgia QSO Party is sponsored by the Columbus Amateur Radio Club, Inc. There are no time or power restrictions and contacts may be made once on phone and once on CW on each band with each station.

For further info contact John T. Laney, III, K4BAI, P.O. Box 421, Columbus GA 31902.

LAKE DELTON WI
MAY 17

The Yellow Thunder 5th Annual Hamfest will be held Saturday May 17, 1975 at the Dellview Hotel in Lake Delton WI. Indoor and outdoor swap areas, 146.94 hidden transmitter hunt, ladies activities, liar's contest, VHF Repeaters, RTTY and much more. Tickets $1.50 in advance/$2.00 at door; $6.50 in advance includes reg., activities and banquet/$7.00 at door. Mail reservations to J. P. Anderson WB9EWR, 624 14th St., Baraboo WI 53913. Talk-in on 146.94 MHz.

DURHAM NC
MAY 17-18, 1975

Durham F.M. Association proudly presents its annual Hamfest, flea-market and F.M. Convention, Saturday and Sunday, May 17-18, 1975. Downtown Ramada Inn, Durham NC. Advanced registration $2.00 – $3.00 at door. Children free. Saturday night banquet – res. $11.00. For info write: Durham F.M. Association, Inc., P.O. Box 8651, Durham NC 27707.

BURBANK CA
MAY 17-18

This year's W6LS Hamfest will be held at W6LS on the weekend of May 17-18. Saturday 10 am – 5 pm; Sunday 10 am – 4 pm. Contests, indoor/outdoor displays of ham gear and accessories, technical presentations, prizes and free parking. Tickets $2; children 12 and under, free. Key people: Ray Biederman WB6NSJ – booths; Ed Satchell WB6MHE – speakers; Dave Cox WA6B1O – tickets.

CEDAR POINT OH
MAY 18

Vacation Land Hamfest Sunday, May 18, 1975. Erie County Fairgrounds near Cedar Point. Huge flea market area. First prize – Regency HR-2B. Tickets – $1.00 advance, $1.50 at gate. Information: Hamfest, P.O. Box 2037, Sandusky OH 44870.

TRENTON TN
MAY 18

The Annual Humboldt ARC Hamfest is Sunday May 18 at Shady Acres City Park, Trenton, Tennessee. Flea market, ladies activities and playground. Contact Hugh Wardlaw WB4SLI, 2678 Cole Drive, Humboldt TN 38343.

BILLINGS MT
MAY 18

Yellowstone Radio Club will hold their annual picnic and an auction. Pot luck and clean out your junkbox. Talk-in on 3910 kHz and 146.94 simplex.

BRONX NY
MAY 18

The Bronx County Historical Society will sponsor a special events stations on Bronx Bicentennial Day, Sunday, May 18. The call requested is KT2BBC. We will operate on 40 meters, phone and CW; 20 meters phone and CW; and 2 meter FM. The Novice bands will be kept active on 40. We want to make as many contacts as possible and ask that all hams look for us. All QSL card

collectors will receive special cards with an SASE or a stamp to M. Alpert, 2425 Fish Avenue, Bronx, New York 10467. Cards from SWLers are also welcome.

Those interested in ham radio can get information on amateur radio licensing at the station.

The operation will be all day Sunday and area hams are invited to come and enjoy the events, shows and exhibits in Van Cortland Park in the Bronx.

WEST LIBERTY OH
MAY 18

The Champaign Logan Amateur Radio Club will hold their annual flea market and auction May 18, 1975 at 12 pm at the West Liberty Lions Park, West Liberty OH. Talk-in on 146.52 and 146.13/73.

IRVINGTON NJ
MAY 18

The Third Annual Irvington Radio Amateur Club Hamfest will be held this year on Sunday, May 18, 1975 at 1:00 pm, in the Irvington P.A.L. Building, 285 Union Avenue (exit 143 on Garden State Parkway North, exit 143b on Parkway South). Door prizes include Drake TR22C, mobile 2 meter power amp, mobile 2 meter gain antenna, plus much more. Admission $1.00, tables $2.50. For advance sale or more info contact WA2PWZ, WA2QQV or WB2SRY. Talk-in on 146.94, 146.52.

WABASH IN
MAY 18

Wabash County Amateur Radio Clubs 7th Annual Hamfest, May 18, 1975 4-H Fairgrounds, Wabash, Indiana. Advance admission $1.00 per person ($1.50 at the gate). Time 7 - 4 pm. Major drawing $1.00 donation per ticket. Hourly prizes 10 am - 2 pm. Technical sessions, large flea market, prizes for: Oldest and youngest ham, ham furthest from home QTH. Free all-night camping, tables available, coffee & donuts. Call-in on Simplex 94-94, 28-88, repeaters 146.13-73, 14763-03. For further information contact: Bob Mitting WB9DKH, 663 N. Spring Street, Wabash IN 46992.

KNOXVILLE TENN
MAY 24-25

The Radio Amateur Club of Knoxville is pleased to announce that its annual Greater Knoxville Hamfest will be held again on May 24th and 25th, 1975. As always, the activities will be located in the Jacobs Building at Chilhowee Park, Knoxville. All activities, including the large fleamarket, will be held indoors, so inclement weather will be no problem. In addition to the fleamarket and various exhibits, we have an excellent zoo, amusement park, and overnight camp hookups right in the Park. No hamfest admission or registration charge. Table rental for fleamarket. Ticket donations for prize drawing on Sunday. Picnic Saturday afternoon. Talk-in on 34/94 and 3980. More info from WA4BTK, John Gwin, 1316 Kirby Road, Knoxville, Tennessee 37919.

INDIANAPOLIS IN
MAY 25

The Indianapolis Red Cross Radio Club will operate a commemorative station, WI9NDY, during the hours of 1400 to 2100 GMT on May 25, 1975, the day of the 1975 500 Mile Race.

The primary operating frequencies will be 3.905, 7.275, 14.295, SSB and 146.52 FM. During the course of the operation, the following frequencies will be operated at various times depending upon band conditions and activity on the primary frequencies: 7.015 CW, 21.355, 28.505, 50.105 SSB; 52.525, 146.94 FM. A special commemorative QSL will be issued for all stations worked and submitting their QSL for verification. QSL to: Red Cross Radio Club, 441 East Tenth Street, Indianapolis, Indiana 46202.

ROCHESTER NY
MAY 31

Western New York Hamfest date is Saturday, May 31st at the Monroe County Fairgrounds. Hotel headquarters is the Rochester Marriott. FCC exams at the Hamfest. Information? Write: WNY Hamfest, Box 1388, Rochester, NY 14603.

GREEN SPEAKS

Wayne Green will be on the FM program at the Rochester Hamfest May 31 from 10:00 – 10:30 – the topic will be the effects of docket 20282 on FM and VHF operating. There are hints that Green feels that this docket will be a catastrophe for VHF and FM development.

Ivan Loucks will be running the FCC forum at 2-3:30 – Gary Hendrickson and Johnny Johnston are scheduled to be present. This should be a hot one as it comes just two weeks before the deadline for filing comments on 20282 – and the call letter restructuring docket should be flying by then, attracting fiery darts.

David M. Eisenberg WB2AGJ
7-17 Fair Lawn Avenue
Fair Lawn NJ 07410

Allband VHF Receiver: Addition

(January, 1975, pages 105-112)

Coil and Parts Inforr.ation

L1, L2 – 8½ turns #26 enameled on ¼" slug-tuned form tap at 2 turns from ground end.
L3, L4 – 8 turns, same as above, no tap.
L5 – 12 turns, as above.
L6 – 6½ turns #18 enameled on 3/8" slug-tuned form, tap at 1¼ turns from cold end.
L7 – 5¾ turns #26 enameled on ¼" BRASS slug-tuned form, tap at 1¾ turns from ground.
L8 – 4¾ turns as above, tap at 1¾ turns from ground.
L9 – 3½ turns, as above, no tap.
L10 – 4½ turns, as above, no tap.
L11 – 5½ turns #26 enameled on ¼" slug-tuned form (iron).
L12 – 10 turns #26 enameled on 1/8" BRASS slug-tuned form.
L13 – Same as L6.
L14, L15, L16, L17 – 2 turns #18 airwound, ¼" diameter, ¼" long.
L18 – 7½ turns #26 on ¼" iron slug-tuned form.
L19 – 5 turns #26 enameled on 1/8" BRASS slug-tuned form.
L20 – 6½ turns, same as L6.
L21, L22, L23, L24, L29-1½" length of #14 tinned copper wire.
L21, L22 – tap at ½" from ground.
L29 – tap at ½" & 1" from ground.
L25 – 7 turns #26 enameled on ¼" iron slug-tuned form.
L26 – 6 turns #26 enameled on 1/8" BRASS slug-tuned form.
L27 – 1½ turns #26 over L26.
L28 – same as L6.
L30, L31, L32, L33 – 6½ turns #18 on 3/8 slug-tuned form, tap L30 & L31 at 1½ turns from ground.
L34, L37 – 18 turns #22 enameled on 3/8" slug-tuned form, tap 4 turns from cold end.
L35, L36, L38 – same as L34 but without tap.
L39 – Miller #1727
T1 – Miller #1725
T2 – Miller #1726
T3 – 455 kHz i-f Transformer
Varicaps – Motorola mv (1634) (25 pF @ 4 volts)
Z1, Z2 – cf-04 (clevite) (451 kHz)
Z3, Z4 – cf-04 (clevite) (459 kHz)
For diodes in Fig. 7 and 8 which have no identification other than the letter "D", use 1N4001 or 1N914 – or any low voltage, high back resistance silicon diode.

. . .WB2AGJ

OLD WESTBURY NY
JUNE 1

The Long Island Mobile Amateur Radio Club (LIMARC) will hold an all-electronic flea market and auction on Sunday, June 1 (rain date June 22) from 10 am to 6 pm at the New York Institute of Technology at Route 25A and Whitney Lane, Old Westbury, New York. Auction will begin at 4 pm. Items to be sold include communications equipment, hi-fi, TV, components, test equipment, etc. Admission is $1 for buyers and $2 for sellers. Call-in on 25/85. Refreshments will be available.

REPEATER UPDATE

ARKANSAS

*WR5AGK	Alma	146.25	146.85
D–WA5YUT	Fort Smith	146.34	146.94
*WR5ADQ	Fort Smith	146.34	146.94
†WR5AGS	Mountain Home	146.22	146.82
*WR5AGA	Russellville	146.22	146.82
*WR5AGK	Van Buren	146.25	146.85

CALIFORNIA

*WR6ABB	Hollywood Hills	222.66	224.26
*WR6ACK	Santa Monica	146.805	146.205

COLORADO

*WRØAHK	Thornton	146.31	146.91

GEORGIA

†WR4AIH	Cumming	147.75	147.15

FLORIDA

*WR4	Belle Glade	146.37	146.97
*WR4ALZ	Bradenton	146.22	146.82
*WR4ALX	Bradenton	449.30	444.30
D–WB4TVE	Daytona Beach	146.235	146.835
*WR4ALG	Daytona Beach	146.235	146.835
*WR4AKH	Daytona Beach	147.75	147.15
*WR4AKH	Daytona Beach	448.00	443.00
†WR4ALA	Fernandina Beach	146.01	146.61
D–WR4AAF	Jacksonville	52.76	52.64
*WR4AAF	Jacksonville	52.03	53.04
D–W4MKD	Miami	CLOSED	
*WR4ALK	Miami	CLOSED	
†WR4AKZ	Miami	223.34	224.94
*WB4CPT	Ormand Beach (RTTY)	147.99	147.39
D–WB4QER	Panama City	146.10	146.70
*WR4ALU	Panama City	146.10	146.70
*WR4AJZ	Pompano Beach	146.01	146.61
D–WR4	Sarasota	146.22	146.82
†WR4ALV	Starke	146.13	146.73
D–WB4QEN	Tampa Bay	147.75	147.15
*WR4ALT	Tampa Bay	147.75	147.15
†WR4ALT	Tampa Bay	146.28	146.88
†WR4ALT	Tampa Bay	147.87	147.27
†WR4AKK	Titusville	146.31	146.91

ILLINOIS

D–W9MJL/9	Danville	146.22	146.82
*WR9AEE	Danville	146.22	146.82

IOWA

†WRØAGK	Creston	146.19	146.79

MICHIGAN

D–WR8AEU	Battle Creek	146.07	146.67
*WR8AEL	Battle Creek	146.07	146.67
D–WR8ABN	Detroit	CLOSED	
D–WR8ABN	Detroit	449.50	444.50
*WR8	Detroit	146.10	146.70
*WR8AFN	Galien	52.01	53.01
*WR8AFN	Galien	448.90	443.90
†WR8AFR	Howell	147.63	147.03
*WR8AFS	Lachine	146.16	146.76
*WR8AFZ	Lansing	146.22	146.82
*WR8AFZ	Lansing	146.34	146.94
*WR8	Lapeer	146.01	146.61
*WR8AEF	Mt. Clemens	222.50	224.10

MINNESOTA

*WRØ	Detroit Lakes	146.25	146.85
D–WØGUP	Duluth	146.34	146.94
*WRØAIM	Duluth	146.34	146.94

MISSISSIPPI

†WR5AID	Greenville	146.22	146.82
*WR5AGR	Lucedale	146.31	146.91
*WR5AHY	Meridian	146.16	146.76
*WR5AHJ	Tupelo Fulton	146.04	146.64

MONTANA

*WR7AFE	Helena	146.16	146.76

NEVADA

*WR7AFI	Reno	222.50	224.10

NEW HAMPSHIRE

†WR1ABU	Concord (CD)	146.34	146.94

NEW JERSEY

*WR2AEU	Lawrenceville	147.84	147.24

NEW MEXICO

D–WA5KUI	Alamogordo	146.34	146.94
*WR5AHD	Alamogordo	146.34	146.94

NEW YORK

*WR2	Albion	146.16	146.76
*WR2	Newark	146.13	146.73
D–WR2AGH	Oswego	146.16	146.76
*WR2AGH	Owego	146.16	146.76

NORTH CAROLINA

*WR4ALD	Franklin	147.84	147.24
*WR4ALC	Hendersonville	52.01	53.99
*WR4ALC	Hendersonville	146.04	146.64

NORTH DAKOTA

†WRØADQ	Fargo	146.16	146.76
*WRØAED	Grafton	146.16	146.76
*WRØAGR	Grand Forks	146.34	146.94
*WRØAFV	Petersburg	146.22	146.82

OHIO

*WR8	Cincinnati	147.63	147.03
*WR8AFO	Lancaster	147.63	147.03
*WR8	Medina	147.63	147.03
*WR8AGO	Nelsonville	147.72	147.12
*WR8	Parma	147.78	147.18
*WR8AFP	Washington C.H.	147.87	147.27

OKLAHOMA

*WR5AHX	Miami	146.22	146.82
†WR5AFW	Norman	146.28	146.88

PENNSYLVANIA

*WR3ADJ	Berwyn	147.96	147.36
*WR3AEI	Corry	146.06	146.69
*WR3ACY	State College	146.16	146.76
*WR3AEN	State College	146.25	146.85

SOUTH DAKOTA

*WRØAIR	Sioux Falls	CLOSED	

TEXAS

*WR5AHU	Kingsville	449.10	444.10

WASHINGTON

*WR7ADB	Marysville	222.34	223.94
*WR7ACG	Seattle	147.69	147.09

WISCONSIN

*WR9AFC	Platteville	146.22	146.82

CANADA

ALBERTA

†VE6VHF	Rocky Mt. House	146.28	146.88

BRITISH COLUMBIA

†VE7ELK	Chilliwack	146.46	147.00
†VE7VIC	Victoria	146.25	146.85
†VE7BEL	Victoria	146.25	146.85

MANITOBA

*VE4OI	Shilo	146.25	146.85

NEW BRUNSWICK

*VE1PL	Bathurst	146.22	146.82
*VE1CO	Moncton	146.13	146.73

NOVA SCOTIA

*VE1	Port Hawkesbury	146.28	146.88
D–VE1	Prince Edward Is.	52.525	147.00
†VE1JD	Sydney	146.34	146.94
*VE1GM	Yarmouth	146.34	146.94

ONTARIO

*VE3MHZ	Brampton	146.28	146.88
D–VE3CRA	Ottawa	146.34	146.94
D–VE3CRA	Ottawa	443.30	448.30
*VE3TIR	Ramore	146.46	147.06
†VE3SRS	Sudbury	146.16	146.76
*VE3WAW	Wawa	146.34	146.94
D–VE3III	Windsor	146.28/146.46	147.06
*VE3III	Windsor	146.46	147.06
D–VE3III	Windsor	147.66	147.06
*VE3III	Windsor	147.60	147.06
D–VE3III	Windsor	444.90	147.06
*VE3III	Windsor	449.90	147.06

PRINCE EDWARD ISLAND

*VE1AIC	Charlottetown	146.10	146.70

QUEBEC

†VE2SP	Alma	146.34	146.94
†VE2IU	Chicoutimi	146.16	146.76
*VE2CRA	Hull Ottawa	443.30	448.30
†VE2TA	Mt. Orford Granby	146.19	146.79
*VE2ASU	N.D. de Buckland	146.70	147.60
D–VE2IU	Saguenay District	146.16	146.76
D–VE2VP	Saguenay District	146.22	146.82

SASKATCHEWAN

*VE5	Melville Yorkton	146.22	146.82
*VE5	Prince Albert	146.46	147.06

ENGLAND

GB3LT	Luton	431.25	433.25
GB3PY	Cambridge	431.35	433.35
GB3SC	Sutton Coldfield	432.025	
GB3DD	Dunstable Downs	1296.05	

** New † Change D Delete*

Caveat Emptor?

PRICE – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

NORTHWESTERN Pennsylvania Swapfest, May 3. Crawford County Fairgrounds, Meadville. Flea market begins 10 am. ($1 to display) Free admission, hourly door prizes, refreshments available. Commercial displays welcome. Indoors if rain. Talk-in 146.94, 146.04-.64 and 29.0 MHz. Map and details: RAE, Box 844, Erie PA 16512.

COMPLETE QSL Catalog! Hundreds of cuts, stock and ink samples. Ten sample QSLs 25¢. Corneilson's Quality QSLs, 321 Warren Street, N. Babylon NY 11704.

FREE: 8 extra crystals of your choice with the purchase of a new Icom IC-22A at $249. With the 10 crystals which come factory installed in the IC-22A, this gives you a total of 18 crystals! For equally good deals on Drake, Regency, Collins, Ten-Tec, Kenwood, Swan, Atlas, Midland, Standard, Tempo, Alpha, Genave, Hy-Gain, CushCraft, Antenna Specialists, Venus, Hustler, Mosley, and others, write or call Hoosier Electronics, your ham headquarters in the heart of the Midwest, and become one of our many happy and satisfied customers. Hoosier Electronics, P.O. Box 2001, Terre Haute, Indiana 47802. (812) 894-2397.

FOR SALE: Heath DX60, HG-10, GD-125, HD-10, HM-102; Micro Comm V.X.O. -- NUX-1; Kenwood R-599A, S-599, 6 ES 2M converters. Steve Black, Star Rte 8, Searcy, Arkansas 72143.

PUSH-BUTTON TELEPHONE to step dialing IC $10.00, TCA430 Quad tone generator $3.00, Memory plane 20k bits $12.00, Wire – 18-2 $15.00, 18-3 $21.00, 20-2 shielded jacketed 1300 ft. $29.00. All above stranded, twisted #26 solid $10.00M, #30 solid $10.00M. PC Board. Some pieces discolored. All G10. 4¼" x 24" x 3/32" one sided 2/$2.00 7½" x 16" x 3/32" $1.50. Following 1/16" two sided 6" x 18" $3.00, 8" x 18" $3.50, 9" x 18" 2/$6.00. Large SASE for list. Interested in quantities of some Mos and special chips. Nothing prepaid. Doug Craton, 5625 Balfrey Drive, West Palm Beach FL 33406.

STANDARD SR-C146MA 2 watt Handy Talkie, 5 channel capacity, supplied with two channels, $240.00; sr-c826MA 10 watt mobile, 12 channel capacity, supplied with four channels, $335.00. Accessories available. Write for catalog and prices. BERCOM ELECTRONICS, P.O. Box 237, Bergenfield NJ 07621. Also TTL devices, 18 popular types available, with spec. sheets.

WANTED: Back copies electronics and ham magazines. Will swap with 1950's CQ, QST, others, or buy. Need old copies ARRL Handbook, Callbook, other amateur radio books and publications. State price or request Trading List. Also want Friden Flexowriter, any condition. Donald Erickson, 6059 Essex, Riverside, CA 92504. (714) 687-5910.

THE 3RD ANNUAL Des Moines Hawkeye Hamfest will be held on Sunday, June 8, 1975 at the Iowa

State Fairgrounds. Plenty of free parking. Flea market, covered display booths available, small charge; open arena, no charge. Dealer displays, prizes, XYL activities. Camping available, small charge. Registration $1.50 advance/$2.00 at gate. Write Des Moines Radio Amateur Association, Box 88, Des Moines IA 50301.

RTTY FOR SALE: Model 15-19 friction-feed conversion it, $13.00, Model 28 style table-stand, $25.00, Model 15-19 printer bases, $7.00, Model 28ASR motors, $25.00. Model 28 printers, gearshifts, cabinets, parts, accessories. SASE for complete list. Motorola T53GKT, Mint, $225.00. Antique tubes. Lawrence R. Pfleger, P.O. Box 21956, Milwaukee WI 53221.

MONTREAL HAMFEST 75, Aug 3, MacDonald College Farm, Ste. Anne de Bellevue, prizes, giant fleamarket, technical sessions, family fun $2.50/adult. Info contact VE2RM, Box 201, PointeClaire-Dorval, Quebec H9R 4N9.

WANTED: Parts for a MITE Corp. Teletypewriter, model TT-299B/UG. Please send list to: Dennis Steele, 630 Braddock Avenue, La Vale, MD 21502.

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send SASE showing make and model number. Joseph C. Crockett K3KUL, 762 S. Gulph Road, King of Prussia PA 19406.

WANTED: Vibroplex bug or paddle; Johnson Matchbox; ARC-5 Xmtr; surplus RT-70/GRC for parts. Condition & lowest price? Ron Lesan W6QJM, P.O. Box 2048, Stockton CA 95201.

STATION Identification collectors, swap cassettes of local PBS, 2 mtr rptrs, and BCB. Arnold Timm, 3207 4th St. N. Mpls., Mn 55412 (SASE Mpls, list).

POLICE AND FIRE Scanner Special – Regency ACT – R – 10 H/L/U 10 channel 3 bands, combined ac/dc 10 free crystals included $169.00 prepaid, dealer inquiries invited, Four Wheeler Communications 10-F New Scotland Avenue, Albany NY 12208.

VERMONT HAM Paradise for rent May-October. New six bedroom chalet S. Londonderry, Vt, Windham County, complete with Drake kilowatt station 80-10, Tower and Tribander, near lakes, theater, shopping, antique auctions, tennis, elevation 1200 feet. Available by week, month or season. Peter Sherry K2AUO. (212) 532-5047 or Box 194 S. Londonderry VT 05155.

FM-YOUR KNIGHT TR-108 Complete kit. Use xtal-vfo. $19.95 ppd. Check or M.O. Calif. res. 6%. Revilo Color, 4725 W. Washington BL., Los Angeles, CA 90016.

WILL DESIGN RIG around your components, send list of tubes and other components with $5.00 fee to Randy McGraw, 900 Clayton Court, Bellevue KY 41073.

TECH MANUALS – $6.50 each: R-220/URR, URM-25D, USM-159, USM-16, PRC-10. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

THE INDIANAPOLIS Hamfest, Sunday, July 13, 1975, Marion County Fairgrounds, Admission $2.00 per person, children under 12 years free. Forums all day, Ladies' and children's activities, good food, free coffee and donuts until 10 am. Inside flea market $2.00 with vehicle, free without vehicle. Free outside flea market. Commercial booth available $25. For information or tickets write: Indianapolis Hamfest Association, Inc., P.O. Box 1002, Indianapolis, Indiana 46206.

NEVER SAY DIE from page 3

mailed out on Thursday and arrives Saturday morning, or at the latest by Monday.

Some amateurs are putting the Hotline info on tape and running it through the local repeater nightly on schedule to bring everyone up to date – some are playing it on the low bands on net sked – this is material of interest to amateurs and thus qualifies for general news broadcast under FCC regs.

WARNING

The Whipple telephone articles are designed to help repeater autopatch circuit developers understand the phone system so they will not inadvertently get into troubles with the phone company switching systems. Readers of 73 know that autopatches and repeaters often rely upon very sophisticated tone control systems (see the 73 book, *Digital Control of Repeaters*), so there is a real danger of the amateur system and the telephone company system not being compatible unless the amateur understands what is happening on the phone lines.

A word of warning should be enough, even to overly enthusiastic teenagers: the circuits for gadgets which have been used for defeating phone tolls are presented for historical purposes and to help designers of amateur control gear. Bell has worked out ways to contend with these things and users are quickly caught. Hotline readers will remember the recent conviction of a well known antenna expert (for another ham magazine) who got out of his field and tried to match wits with Ma Bell.

Autopatch and control circuits will continue to be developed by experimenting amateurs as long as they don't create problems, so the publication of these circuits is important for amateur radio. Don't mess around . . . Bell has absolutely no sense of humor about these things whatever. One ham lost his job with the phone company when he made up an autopatch unit in a blue colored box, and it took him thousands of dollars in legal fees to get his job back. The mere blue color seemed to do it to Bell, who was suffering from an attack of so-called Blue Box units which were running all through the long distance circuits without any billing. D-o-n-'-t m-e-s-s.

. . . W2NSD/1

STOLEN: GTX-2, serial #2958, 10 crystals. Contact Michael McNeely K9HCK, 618 Sheridan Road, Evansville IN 47710 or Evansville Police Department.

FILCHED: HT200, serial #U24407, lost from Grand Rapids MI Airport. Contact Ray Thomas WA8WEJ/6.

PILFERED: 2 meter FM rig, serial #2402350. Contact Jimmy Jones W8OYL.

PURLOINED: Regency HR-212, serial #2400829, at the Massillon Ham Auction. Contact Bob K8COT.

BURGLED: SB 144 fully crystaled, serial #460118 in Wilmington, Delaware. Contact Ralph L. Hairsine K3MPZ, 1408 Wedgewood Road, Wilmington, Delaware 19805.

LIFTED: ICOM IC-230, serial #2266. Contact Tony Gargano W2EHB, 32 Bryant Road, Blackwood NJ 08012.

RIPPED OFF: IC-230, serial #1062, acoustic pad, shure noise cancelling mike. Contact Fred K4CLJ.

PIRATED: Clegg, FM 27-B, serial #27093-2683. Contact Blain W4BNS.

LOOTED: ICOM IC-22, serial #8768 with microphone. Contact Amarillo TX Detective Bureau or WB5BKL, 1136 Cinderella, Pampa, TX 79065.

ROBBED: Motorola Mocom 70 Base Station, L53BBB-3100AM, serial #KA2090. Contact Richard M. Hambly WB2TNL, 16 Gaslight Drive, 1, South Weymouth MA 02190 by mail or telephone collect (617) 335-8574.

SHANGHAIED: Standard Handie Talkie Model 146A, serial #310377 along with Standard Mini-Mike. Contact Hy Chantz WB2HYW.

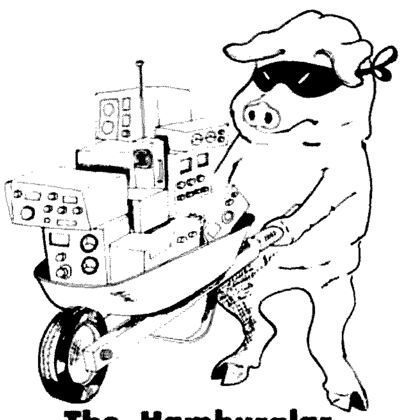
MISAPPROPRIATED: Regency HR2B, serial #49-01726. Contact W2EKB.

KIDNAPPED: Standard SR-C 826M, serial #11082 with xtals for 9 positions. Contact John Gubernard K2LSX, 252 Park Avenue, Cliffside Park NJ 07010.

MADE OFF WITH: TR-22, 12 channels, channel 6 wired together plus GLB homemade synthesizer. Contact Terry Fox WB4JFI.

ABDUCTED: 2 meter transceiver, serial #620615. Contact Loal J. Broulette FTGC, FT "C" School Staff, Great Lakes IL 60088.

SWIPED: Yaesu FT401 A, serial #316104, Yaesu FV401, serial #679927, Collins 75A4, serial #5564, Johnson Valient 2916. Contact K2UPD.



The Hamburglar

STRIKES AGAIN!

TAKEN: 5 Collins Model KWM-2A transceivers, serial #11359, 10731, 10095, 11218 and 16066. Two Collins Model 30LI amplifiers, serial #10620 and 11012. Three Collins Model 312B-5 Control Radio, serial #10016, 10394 and 59502. One Collins Model 516F2 power supply, serial #18607. Three power supply, serial #12046, 12045 and 12015. Two radio receivers, serial #2918 and 1168. One Multimeter, serial #11065. All taken from the MARS Radio Station, Fort Meade, Maryland. Contact local FBI office and/or Fort Meade Field Office, USACIDC, Fort Meade, MD 20755, telephone (301) 677-6446 or 677-6622.

PILLAGED: FT101 with 160 meters, serial #82L129340/CWF. $100 reward offered for return or positive information leading to its recovery. Contact Paul Skitzki W1FX, P.O. Box 187, Portsmouth RI 02871. (401) 683-0326.

RIFLED: FM27B with D.A.R.T., serial #27403-1624. Contact Gary Black, 3872 Royal, Berkley MI 48072, (313) 546-8859, or Det. Sgt. Flynn, Berkley Police (313) 541-9000.

HIJACKED: FR-2514 Sonar scanner, one Sonar FR-2515 scanner, G.E. single freq control head and one Motorola Control Head (MOTRAC), Motorola PTT mike and one Shure PTT mike. Contact Los Angeles County Sheriff (Lakewood Station), 5130 Clark Avenue, Lakewood CA 90712. Burglary report file No. 03421. Sheriff (213) 866-9061. K. Higgins WB6HSK (213) 425-1174.

RUSTLED: Motorola HT-220, serial #L24J6W and Motorola HT-220, serial #M74J74. Contact Mr. E. S. Janecek, Union Carbide Corporation, P.O. Box 3370, Brownsville TX 78520.

BE MY GUEST from page 5

station within the rules, is courteous to others, doing his "part" for amateur radio, then what can this accomplish other than one large mess of paperwork? If you are going to re-examine amateurs on a large scale, then re-examine all amateurs regardless of license class. Is the amateur who was licensed 35 years ago as technically competent as the 15 year old high school kid who got his Tech ticket last week? Is longevity the one and only prerequisite to technical competence? *Why waste time penalizing those who are acting in the best interest of amateur radio when this time could better be spent in silencing those incompetents that willfully and maliciously jam our repeaters and HF public service nets?* Did I say time? I should have said time and money. Re-examination for violation of the rules I favor since it is the one way of ridding amateur radio of detrimental elements that could harm it in the long run.

If it is true incentive toward up-grading that 20282 is aimed at, than rather than re-examine for the same class, put a maximum license term on all license classes and let this be an up-grading program rather than a penalization program. I suspect that under the present scheme, the number of good operators we would lose might well surpass the number of bad ones we would retain. What kind of an incentive is it for someone who has been a Tech or Conditional for many years, obeyed the rules without question, been the kind of operator that we have been proud to call a fellow ham, to find that he must cram his fool head off for no reward other than the partial continuance to what he or she already has — and then to have to look at the free access to the Communicator license, and what is being handed to them on a silver platter.

One thing that the commission failed to consider is that a Conditionally licensed amateur who entered amateur radio 20 years ago may have one heck of a hard time starting to "learn it all again." Many might elect to down-grade to Communicator rather than hassle the whole thing. On VHF especially, you could conceivably quickly wind up with millions of Communicators dependent upon a handful of Experimenters to provide the "mountain top" hardware and this could easily lead to dictatorship on the part of a select few over the masses. Unless I miss my guess, this is a bit contrary to what America is all about. Not that this would happen, hopefully not, but under 20282's present structure it could.

While the following may be a minor point, after you think about it, it makes a lot of sense. At the last SCRA meeting, an interesting point about semantics was raised by someone who is truly the father of modern repeater communication, and a person I have a great deal of admiration for: Art Gentry W6MEP, owner of WR6ABN, perhaps the oldest continual operation repeater in the country. To paraphrase Art, a person is an "Experimenter" until the time he reaches a level of technical competence to be called a "Technician." I agree with Art since in daily life one is an experimenter until such time as he or she attains the necessary knowledge to function as a technically competent professional in whatever profession that one might choose. Maybe the two license class names should be interchanged to follow this particular line of thought; I think so.

This brings us to another penalty that will be imposed upon the General and Technician of today. While I can go with the reduced power limitations to be imposed upon different license classes, please tell me how such a program can be administered without periodic inspection of each and every amateur station in the country? I realize that today's modern electronics entails some highly sophisticated equipment, but I have yet to hear of any piece of equipment that can listen to an incoming signal and read out the power level that the transmitter is operating at. Are we beating dead horses again?

I still find it a bit hard to believe that after developing some of the most sophisticated communication and control systems around today, the Technician will be rewarded for his years of effort by being prohibited from using tone-burst, touchtone and sub-audible tone squelch in a like manner to the General losing his Slow-Scan TV and RTTY. Is this incentive to expand one's knowledge or punishment for years of meritorious service? How many repeaters that are owned by or licensed to Technicians will just "go away" because the said licensee will feel he has better things to do with his time than to start from scratch and pound "book and key" just to retain what he already has? The damage may well be irreparable.

To me amateur radio is a hobby, one that I love but far from the only thing in my life. My job and family obligations are far more important and I suspect that the same holds true for many of you. With many of us working more than one job in order to make ends meet (I personally function as a consultant to a University Research Program and as Tech-Rep for a Bio-Med Electronics Company in addition to my regular 8 hour a day job as Television Service Technician for one of the largest merchandisers in the country) in this time of prolonged economic crisis, where do you find the time to start over again?

Amateur radio is my hobby, my escape from the ills of the day, not another job on top of what I already have to do. There are but 24 hours in a day. Perhaps I am crazy, but I enjoy amateur radio. It fulfills a need in my life and I am grateful for its existence. My "thing" is writing about it, all aspects of it since about 1961, with a short break in this routine between '63 to late '71, though not by choice. I went under the byline "staff" in most of those cases. There are those that build repeaters, bounce signals off the moon, travel to the farthest corners of the world on DXpeditions, put up satellites like the Oscars, and just sit home and chew the fat. Each has his little bit to give that builds amateur radio. Each of us has his or her place in it.

If it's numbers that we need to secure the longevity of amateur radio, then a Communicator Class license is one route, but it should be subject to the same if not more stringent regulation that all other license classes are subject to. If you are going to re-examine any single class of "Conditionally Licensed" amateur, then the Communicator MUST be included in this. Why should today's currently licensed amateurs be penalized when at the same time the un-trained are being handed free, what we now have? If you are going to create a Communicator Class of license, then it too must be subject to the same incentives to up-grade that are to be put upon all other license classes even if this means up-grade or out after the initial license term. Yes, we need a Communicator Class license because we need numbers to survive, but how far must we sacrifice quality in order to obtain quantity? I want a Communicator Class license but only if it is treated with the same objectivity as all other license classes, and only if!

. . . WA6ITF

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MAY 1975

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May – 1975

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4	5	$\boxed{6}$	$\boxed{7}$	8	9	10
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$\boxed{18}$	19	20	$\boxed{21}$	22	23	24
25	$\boxed{26}$	$\boxed{27}$	$\boxed{28}$	$\boxed{29}$	30	31

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	7A	7	7	7	14	14	14	14A	14A	14
AUSTRALIA	14	14	7B	7B	7	7	7	7	7	7	7A	14
CANAL ZONE	14	14	7	7	7	7	7A	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7A	14	14	14	14	14
HAWAII	14	14	7B	7	7	7	7	7	7A	14	14	14
INDIA	7	7	7	7B	7B	7B	7A	14	14	14	7A	7
JAPAN	14	7	7	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	7	7	7A	14
PUERTO RICO	14	7A	7	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7A	14	14	14	14A	14	7A
U. S. S. R.	7	7	7	7	7	7	7A	14	14	14	14	7
WEST COAST	14	14	7A	7	7	7	7	7A	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	14	7A	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	14	7	7	7	7A	14	14	14	14A	14
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7	7	7A	14	14	7A
HAWAII	14	14	7A	7	7	7	7	7	7A	14	14	14
INDIA	14	14	7B	7B	7B	7B	7	7	7A	7A	7	7
JAPAN	14	14	14	7	7	7	7	7	7	7	7A	14
MEXICO	14	7A	7	7	7	7	7	7	7	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	14	7	7	7	7	7A	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	14	14	14	14	14	7A
U. S. S. R.	7	7	7	7	7	7	7	7	7	7A	14	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7	7A	7	7	7	7	7	7	7	7	7	7
ARGENTINA	14A	14	14	7	7	7	7	7A	14	14	14	14
AUSTRALIA	14	14A	14A	14	14	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	7A	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7	7	7	7	7A
HAWAII	14	14A	14	14	7A	7	7	7	7A	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	7B	7	7	7	7
JAPAN	14	14	14	14B	7	7	7	7	7	7	7A	14
MEXICO	14	14	7A	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	14B	7B	7B	7	7	7	7A	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	7B	7B	7A	14	14	7A
U. S. S. R.	7	7	7	7	7	7	7	7	7A	7A	7	7
EAST COAST	14	14	7A	7	7	7	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73

amateur radio

JUNE 1975

ONE DOLLAR

SSTV Monitor

Cheapo Super Beam

Burglar Alarm

432 MHz Power

Ma Bell's Circuits

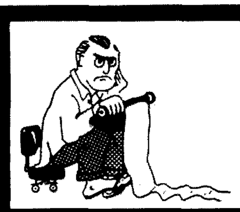
Minirepeater

73 amateur radio

#177 June 1975

COVER: When you're in the Hartford area, listen for lovely Cindy Tucker over the WR1AEC repeater. This pioneer repeater, with one of the finest locations in the Hartford area, is one of the most active 220 MHz repeaters in the country. It has been on the air for about a year and is the envy of many other local repeater groups due to its clean operation and autopatch facilities. Photo credit goes to Bruce WA1GDX and credit for organization and production goes to Arnold Chase WA1RYZ.

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $8 for one year in North American and U.S. Zip Code areas overseas, $9 per year elsewhere. Three years, $16 and $17 overseas. Second class postage paid at Peterborough, New Hampshire 03458 and at additional mailing offices. Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19004.



NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

JUNE 16TH DEADLINE

Comments on docket 20282 – "restructuring" – are due the 16th, complete with 14 copies. Before I get into a discussion of why, day by day, I am more and more opposed to virtually every aspect of this proposal, there are a couple of other bases to cover.

The fact is that one single copy of your comments will do a lot of good if you are hung up on getting free photocopier time and supplies. This comment will get into the main file and be used by whoever loses the coin flip and has to put things together at the FCC. Extra copies go to individual Commissioners, and other sections of the Commission – many of whom could care less about our problems or future. Moral: Don't let that 14 copy nightmare stop you from getting in your two cents . . . er, ten cents, today.

You, like the rest of us, may be a little hazy about the exact wording of the docket. Read it over again – February issue of 73 – complete.

NOW! There are two aspects to this docket that you should consider . . . first make a note of every way that this docket will effect you personally – what privileges it will take away from you – what it will gain for you (if anything) – what it will cost you in license fees – in study time – in lost time going for exams under the beady eyes of FCC examiners. Secondly, take a good look at the docket from the viewpoint of amateur radio as a hobby in the long run.

Will a Communicator license bring in millions of CBers or will it result in as little increase in ham tickets as the Novice and Tech licenses did – despite the high hopes of the FCC and dire warnings of curmudgeons? The fact is that we *don't* know and can only make a wild guess.

Few amateurs have any enthusiasm for thousands of handle-wielding CBers coming on the repeaters. Club newsletters are generally in agreement that this will bring about a large scale closing of repeaters to these Communicators. Can the Communicator ticket work if amateurs refuse to talk with them? The general opinion is no.

My own opinion is that this whole matter has been brought up with too little consideration for the impact on amateur radio. There is an air of hysteria over the stagnation in amateur growth – more hysteria over the unbelievable CB growth which shows serious signs of spilling over via 220 MHz into amateur bands – and frustration on the part of Walker over the failure of "incentive licensing" to force amateurs into the Extra Class. Is docket 20282 really an answer to any of these "problems?" I think not.

We've lived with five classes of ham ticket (eleven, counting sub-classes) and I have no doubt we can live with seven (seventeen, counting sub-classes) – but I don't think it will be healthy. To me this is against the very precepts of America. In amateur radio, in particular, we are all supposed to be equal – a big group of people all in communications with each other where you can one minute talk with a garbage man and the next with a senator. It is utterly alien to the whole system of license classes where Techs talk only to Techs, Generals talk to Generals, etc.

Look at it another way. When you work someone and he announces that he has an Extra Class ticket – why has he mentioned this? Obviously it is bragging and intended to put you down. An Extra Class licensee has to either keep quiet about it or else put himself down if he is going to maintain much communications with lower classes. It is an unhealthy situation.

The same problem exists with Techs. Most Techs are very defensive about their license class – and many spend a lot of time explaining to higher classes that they could get their General if they wanted to – that they got their Tech ticket honestly – etc. Terrible situation.

So now we are well on our way toward making it even worse with two more classes. Good grief! You want to bet that many Experimenters will manage to feel inferior to Generals

and Advanced? And with the new system of call letters the operator won't even have to say anything for his call will give him away. How long will Generals put up with Extras coming down to slum in a crowded General band?

Well, enough of that.

Sure, we need growth — but we can get it anytime we really want to just by setting up ham classes in our clubs and getting high school kids into them — we'll have all the hams we can manage without giving away ham tickets for free. This is what the Japanese have done and they've proven the idea works. Oh, we can set up a superannuated CB license and fill in one or two VHF bands with Communicators — it's always possible. But I think we'll lose a lot of our self respect.

I have to admit that at first I liked the idea — but despite the opinion of my detractors that I won't change my mind about things, I have changed a lot on this one.

FILE YOUR COMMENTS

Drop your comments on 20282 to the FCC, Amateur Division, FCC, Washington DC 20554 and get 'em in the mail by the 15th of June.

If you think I'm wrong about clubs being able to generate ham growth then you'll probably favor the docket. If you think I'm wrong about thousands of CB/Communicators forcing most repeaters to go closed then you'll favor the docket. If you like the idea of snobbery between classes . . . etc.

As far as the first aspect of the docket is concerned . . . the way the restructuring would effect you personally . . . which is about all I've heard discussed over the air, at club meetings, or seen in comments filed so far . . . what possible difference should that make in rules that we all are going to have to live with for quite a few years?

It probably won't help my popularity when I let you know that I now, after a lot of thinking about this, favor our going back to a two ticket system — beginner and advanced. This may destroy any rapport that I've built up with liberals, since it essentially takes us back about 30 years — but having been both there and here, there was better, at least as far as amateur licenses were concerned.

To me amateur radio is amateur radio and this splitting of it into HF and VHF licenses is bad news. I enjoy every band I can operate — 160m is enormous fun — I love 75m DXing and rag chewing — 40m is certainly a challenge and some top RTTY boys are there — 20m is the backbone of amateur radio . . . I don't count a country as really worked unless I get it on 20m — 15m is a little weak these days — 10m . . . sigh — 6m would be okay if we could interface our two meter repeaters again — two meters is two bands . . . FM on the high end and DXing and SSB on the low — 220 is coming along nicely — 450 is three bands . . . ATV . . . FM . . . and Oscar! Better make that four — add in a touch of DX and moonbouncing.

The Experimenter who has to get another ticket to go on 160m is probably going to stay off 160m. You can vote that enormously complicated system in if you want, but I'll say right now that it isn't going to work. Bitch all you want about me being reactionary, the fact is that my predictions have been disturbingly accurate.

Amateur radio will be better able to meet its responsibilities if it is left with a minimum of classes and a minimum of restrictions. We need to be free to experiment, not be hemmed in at every turn by rules. Repeater and VHF systems development were held back disgracefully by the ill thought out and overly complicated repeater rules. Experimenters are presently being hamstrung by restrictions on telemetry transmission. More and more amateurs are into developing computer systems and these could be tied together by radio much better than telephone — if our rules permitted. Some of the RTTY chaps are

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DOCKET 20111

Report and order regarding special events station licenses . . . effective May 27th applications for special events stations should be sent by letter to the FCC Amateur Division, Washington DC 20554 . . . stating the name, mail address, and including a photocopy of the Advanced or Extra Class license of the applicant, plus a signature . . . then give the name and a description of the celebration for which the special events station license is justified and the significance of the event to the public or to amateur radio . . . the location of the station (may not be mobile or portable) and any special callsign requested. The station license is $4 and a special call request calls for $25 extra.

HOTLINE HEADLINES

Bicentennial callsigns released by FCC — W/AC, K/AD, WA/AA, WB/AB, WR/AF, WN/AK — starting Jan 1.

WA6LBP Wins Tower Battle — *another nasty tower case won* by amateur radio — this time in Ventura CA.

CBer with stolen 2m rig lured into coffee break and bust by cops over WR1ABQ in Derry NH.

Oscar 7 being zapped by Gulf non-ham signals — may be Hiran or TI's ERENS systems — whatever it is, it has been hurting Oscar 7 at times . . . seriously.

Ham PR going strong — Newsday article — VFW magazine article — Englewood NJ mayor declares ham week — AMC news piece on ham help during Alabama tornado.

SSTV Contest winner works 44 countries and 101 contacts, six continents! Paul Furman WB4ECE of Dunwoody GA was this year's winner.

Phonetele $30 million suit against Bell may help amateurs — involves phony couplers which run up charges, but add nothing to the circuit.

NC/TN repeater war solution proposed by Carolina-Virginia Repeater Association. WR4ADO requested to change frequency after careful study of facts.

Job Op: 73 Magazine is looking for experienced hams/writers to work on Hotline, books, etc.

QST Cops Out: reveals K2OAW as previous author to recent QST counter article, but gives no reference to publication in 73 of updates and improvements in the circuit.

Amsat meeting — Oscar 8 set for 1978 — DL/VE/VK groups will cooperate to design and produce the flying repeater. It'll probably be an advanced 435/145 MHz system.

MARS theft hoax story being investigated by AF. Was there a theft of $3.5 million? Who sent out the story datelined Air Force Information Service?

Ham biz up — manufacturers falling further and further behind as economy picks up and rush is on for HF and VHF gear, ICs, everything!

CQ makes papers — even an Action Line can't get CQ to pay author, it appears. This will help offset some of the good ham PR in other papers.

BE MY GUEST

Visiting views from around the globe.

What is ATIS?

The Federal Communications Commission has recently released a proposal for changing certain parts of the Rules and Regulations to require installation of an Automatic Transmitter Identification System on all radios manufactured for the Safety and Special Services beginning one year after adoption of final rules (FCC Docket 20351). This will apply to Citizens Band, Aircraft, Commercial, and other VHF services, but not directly to amateurs. The Commission specifically cited its difficulties with enforcing radio regulations in an environment where a large number of operators fail to properly identify themselves or their station. The new rules would end this problem by requiring that an automatic identifier be placed into each transmitter by the manufacturer. The ATIS identifier would send an audible tone code sequence containing the station's callsign at the beginning, end and every 30 seconds during a transmission using the ASCII code ("8-level" Teletype code). This burst of data, lasting about 1 second, would start with the special character "SYN," followed by the station call (or the transmitter serial number for equipment not yet assigned to a station), followed by "i" (little i), transmitted as a two tone frequency shift between 1285 and 1115 Hz at 50% modulation. This identifying signal could be displayed real-time on any standard computer terminal, or tape recorded and slowed down for decoding by ear.

The Commission proposes that these devices be "an integral part of the transmitter," and in the case of Class D Citizens Band, it " . . . shall be designed in such a manner that the transmitter will not function unless an encoded ATIS device is installed and operating." The FCC wants the device to be made tamperproof, yet the ATIS must be reprogrammable since a licensed technician will encode the purchaser's call after the transmitter is sold.

The manufacturers have apparently assured the FCC that this is practical to accomplish without adding much to the cost of the equipment. The ATIS would probably be a single, many legged IC, possibly incorporating portions of the transmitter's frequency synthesis circuitry to discourage removal or tampering. It should not be any more complicated or costly than a pocket calculator chip when produced in large quantity.

The ATIS plan, as proposed, has several drawbacks. One might be the possible interference with voice intelligibility, especially on short transmissions. A second would be the psychological effect of the incessant identification codes following each mike-squeeze, and the added tail at the end of each transmission.

Only new equipment would contain the ATIS devices, thus leaving millions of radios in operation without the automatic identification feature. The problem of seeing that the ATIS is immediately coded after equipment sale or trade by an *honest* technician is not dealt with; the licensee, rather than the radio store, would be responsible for getting this done, with no assurance that it would be (tracking down a bootlegger through an equipment serial number seems unlikely). The rules changes in their present form do not offer much toward the solving of enforcement problems on 27 MHz.

For the ATIS plan to be useful at all it would have to be evenhandedly

MOBILE CALLING FREQUENCIES

For many years now, certain frequencies have become recognized internationally for RTTY and latterly for SSTV. We felt it high time that radio amateurs knew where to listen for mobiles and hence, where to call if operating from the car.

Accordingly, the Amateur Radio Mobile Society, having members in all continents, has adopted the following frequencies for Mobile Calling Purposes:

10m band – 28550 & 29550 kHz
15m band – 21210 & 21370 kHz
20m band – 14110 & 21370 kHz

In addition, as far as amateurs in IARU Region 1 are concerned, we will use 3755 & 7050 kHz for calling purposes.

Now we realize it is too much to expect universal acceptance of our proposals and any attempt to get together any kind of international conference would be doomed to failure from the start, inevitably becoming bogged down by paperwork and waffle.

We are contacting the editors of the journals of all major, national amateur radio societies asking them to publicize our proposals, as well as contacting the independent amateur radio press.

In view of the prevailing poor propagation conditions in the 15m band, we have shifted our members' weekly net to the 20m band. Consequently, the new schedule is:

Saturdays 1330 GMT on;
14320 kHz; G4AMS.

We particularly listen for members but all mobiles are most welcome to call in. The station is operated by our Chairman, Jim Farlow G3BXI, the station being a KWM-2 + 30L-1 to the TH6DXX at 70 feet.

Norman Fitch G3FPK
Purley, Surrey
England

applied to all users of the radio equipment. This would require that the seller of the equipment take the responsibility of getting the buyer's callsign encoded into the ATIS device, *at the point of sale,* with strict sanctions against dealers found not in compliance. Since we could assume that "(SYN)EIGHTEENWHEELER-DADDYi" would not be an acceptible station identification, it would then be necessary for the purchaser of a radio transmitter to produce a license and callsign *at the point of sale,* something that has not been required up to now. The ATIS requirement must also be made retroactive to include at least the new SS8 rigs sold for Citizens Band and the VHF-FM rigs on the marine frequencies. Since the AM equipment in both cases is scheduled to be phased out, installation of ATIS in the recently sold equipment would mean total coverage within a reasonable and definite time frame.

As was mentioned, amateurs are not included in this plan for automatic transmitter identification. We may, however, find applications for these miniature identifiers on the VHF bands. One suggestion might be for the members of a private repeater group to install the identifiers in their transmitters. Since the code used is standard ASCII, it is machine readable and a small processor could be incorporated to compare the station's call to a list of valid member stations in memory. A member of the group could be given full privileges on the repeater, while a non-member station, or a station with no identification signal, would have only limited privileges.

The FCC might be willing to settle on some compromise for the automatic control of repeater access based on this ATIS system, relieving the control operators from the tiresome task of monitoring. If stations without ATIS identifiers were excluded from using the repeater altogether, then the stations that do get through would certainly be licensed operators, known to and authorized by the repeater trustee. If that doesn't satisfy the FCC, then perhaps a digital record of "who used the repeater when" might be accepted. Once again the ATIS code makes it possible to record the station ID and a binary coded date/time reference in a very small space on a tape cassette (compare this with the miles-long tapes required for a complete audio recording of repeater use). A real time repeater log could even be printed out on a Teletype machine, if every user had the ATIS on his transmitter.

An even more elaborate system might allow a station to record a message in the repeater, using touchtone codes to control the recorder and inform the repeater as to which club member the message is directed. When the "addressee" next uses the repeater, it will recognize him by his ATIS code, and play out the prerecorded message. For these uses, the identification signal need only occur once at the beginning of each transmission. Sub-audible frequencies may be employed instead of 1200 Hz ±85, if that proves to be an annoyance.

Other applications will no doubt suggest themselves as the ATIS identifiers become available at low cost, a beneficial spinoff to amateurs from the problem of illegal operating practices now running rampant in the other radio services.

. . . **J. R. Johnson WA5RON**

BYRON KRETZMAN ON 20282

Opening Pandora's Box

The following is a text of a talk given by Byron H. Kretzman W2JTP before the Larkfield Radio Club at a regular meeting April 11, 1975, in Huntington, Long Island.

I have asked for "Equal Time" to present to you my opposition to the views Harry Dannals gave to you March 14th, the same views expressed by Stan Zak, the Hudson Division Director. (I see I haven't that much time, but it won't take me that long to counter his "hard sell.") There are two main areas of my disagreement with the "party line" these fellows have been spouting in reference to Docket 20282:

1 – The recent ARRL poll was limited to members only.

2 – The desirability of the "no-code" Communicator Class.

First, limiting an ARRL poll to members has not been general practice in the history of the ARRL. (When they first did that in 1938 the results were disastrous to occupancy of the 5 meter band.) Now, there exists a standing resulution adopted years ago by the Board of Directors. It says:

"On any matter, the Board may order the taking of an advisory, informative poll, through the columns of *QST,* as to the wishes of the amateurs or the members, as the case may require; and thereafter the Board, in acting upon the question presented, shall take into consideration the result of such a poll, the number of expressions received, and the percentage of votes by which such poll was determined. Whenever an advisory poll is taken through the columns of *QST* . . . , then there shall be provided a detachable postcard in the pages of *QST* to be used for balloting purposes; and the call for such poll and information published concerning it shall be printed in reasonably prominent form, using type and headings no smaller than those used for articles in the same issue."

This was done, for example, in February 1948 on the question of asking the FCC to allow 'phone on 40 meters. Why wasn't this done this time on Docket 20282? Let me read you Stan Zak's reply (letter of February 22, 1975):

"A survey of all 225,000 amateurs would be rather expensive. I believe League members are very well informed through *QST,* club bulletins, etc., on various happenings so that I would value an opinion from a League member (as) opposed to one who just sits in front of his rig and doesn't care about anyone else. This is one of the benefits of League membership.

"I myself cannot get too enthused about a non-League member or his opinions. They expect the League to do everything for them, to reap the rewards without benefit of supporting the League . . ."

What kind of an answer is that? Harry Dannals gave me a similar reply on March 14th. He said, in essence, "Since there are about 200,000 non-member hams, we can't afford to consider their opinions."

Let me ask you, "Why are there so many non-members?" (The ARRL is "the only game in town.") Sure, some are discontents. Well, I travel quite a bit, and I think the major reason is economics – many of these fellows can't afford the $9 dues. You may laugh, but let me tell you that we live

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Autobiography of an Ancient Aviator

W. Sanger Green
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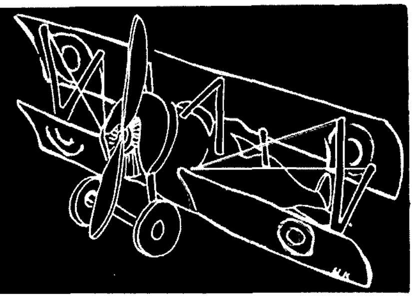
Brooklyn NY 11230



VACATION AT POST AND KELLY FIELDS

We arrived at Lawton, Oklahoma on the afternoon of May 19, 1922, made our way out to Post Field, and reported in. The matter of married quarters on the field was solved the next day by assigning us to a low ranking officer's house. (Who ever heard of a married Flying Cadet?) The place hadn't been lived in for a while, judging by the quantity of mice, ants, roaches and scorpions we had to clean out. We never did quite get rid of the scorpions. They kept popping up in unexpected places such as on the wall in back of pictures, etc.

Several members of our class had preceded us to Post Field. They greeted us with the news that their only duty so far had been "bunk fatigue" and that there seemed to be some doubt as to whether our advanced training was to be at Post Field. It seems that a class of officers, among them Gene Vidal, had not yet finished their training, so no instructors were available for us cadets. Gene was famous as a West Point football star. He was to be Gore Vidal's father. I was associated with Gene several years later in the Ludington Line.

There was a flying game that I was able to participate in a few times. Ten to fifteen cadets and student officers would be assigned to DHs (DeHavilands) on the line, then go to the operations office and each put $2 into a pool. Then we would put our names on slips into a bag and have the operations officer draw one out. The one whose name was drawn would take off and have a ten minute start. He carried some identifying article and had to land somewhere on the reservation. (The Fort Sill reservation was something like ten by twenty five miles in area.) Then the others would all take off at once and try to find him. The first one to find him, land near him and bring the identifying article back to the operations office would split the pot with the pilot who took off first. There were usually a number of near collisions in the mad take off scramble. I won once. It was fun.

On June 20th I received orders to proceed to Kelly Field, arriving there not later than 1 July. By that time Cleo was quite pregnant and was expecting in early September. We wanted the baby to be born in Littleton, New Hampshire so we

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Some farmers used to maintain mud holes . . .

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decided that it would be better for her to join her parents there for the last two months of her pregnancy than to go to Kelly Field for a few weeks. So on June 25th I put her on the train for New Hampshire.

Cadet John Paul Riddle had a 1920 Dodge touring car, so he invited myself and three other cadets to ride to Kelly Field with him (and share the expense). We got away from Post Field on June 28th and arrived at Kelly on June 30th. We made pretty good time on the 500 mile trip, considering the road conditions in those days. There were practically no paved roads except in cities and towns. We only had three flat tires on the trip. In those days you changed the tire and inner tube — not the wheel. Also you carried chains to get you out of mud holes in case no farmer was near to pull you out with a team of horses ($2). Some farmers used to maintain mud holes in the road near their farm.

There were two Kelly Fields at that time. Kelly #1 was a flying instruction field during WW1, but now housed an air depot with storage hangars and aircraft and engine maintenance and repair shops. Kelly #2 was adjacent. All the routine and instruction flying was done there. When we arrived we found that the Flying Cadets were quartered at Kelly #1. The Carlstrom Field class following ours arrived a day or so after we did, and was combined with us to become the class of 1922.

There followed three weeks of no classes and no flying. We made good use of the officer's club swimming pool which was turned over to us four afternoons a week. Ed Conerton and I bought a 1913 Cadillac touring car for $20. It was something of a maintenance problem but it lasted while I was at Kelly Field. Gasoline at the Post Exchange service station was only 10¢ a gallon so we visited most of the points of interest in and around San Antonio. We also made a little extra cash once in a while by hauling other cadets to and from San Antone.

During this waiting time I visited the Kelly #1 hangar where Jimmy Doolittle was modifying a DH for his projected transcontinental one stop flight from Daytona Beach, Florida to San Diego, California via Kelly Field. He did everything he could to streamline the ship, and also installed auxiliary gas and oil tanks and some navigating instruments that were an improvement over the regular equipment. Our Advanced school started before he finished the job, so I wasn't around to see it completed. I know that he tested it several times before he was satisfied with it. I got to be pretty well acquainted with Jimmy during the short time I was able to call on him. He made the flight successfully after I had left Kelly.

Along toward pay day each month I was a trifle short of cash. I solved this problem by hocking the gold watch my grandfather Sanger had willed me (now valued at $250) for $20 and redeeming it right after payday for $21.50. Two or three Saturday evenings a month Ed Conerton or Art Caperton and I would step out to the extent of having dinner at the St. Anthony Hotel roof. Dinner and music at $2 each with a 25¢ tip. Caperton and I couldn't go the same evening because I had the only presentable civilian suit that fitted Caperton.

The Advanced Flying School got under way full throttle the last week in July — ground school in the morning and flying in the P.M.

Next month I'll tell you about the ups and downs of the ground and flying schools, including an account of my furlough and the happening of September 3, 1922.

AMSAT

FIRST DAY COVERS

Official first-day cover envelopes commemorating the launch of AMSAT-OSCAR 7 are now available in two styles from AMSAT for $1.00 each (or 5 IRCs). Be sure to enclose a business size (=10) self-addressed, stamped envelope (or an additional IRC in lieu of stamps). The first day cover envelopes were postmarked at the launch site, Lompoc, California, on the day of the launch, and make an excellent collector's item for any ham shack or philatelist.

OSCAR NEWS

Oscar News is a regular U.K. publication designed to inform and assist all users of OSCAR satellites. The publication contains operating tips, orbital data and info on OSCAR DX activity. Contact Tony Bailey G3WPO, 5 Erwin Way, Burgess Hill, RH15 9PN, England for sub info.

Satellite Orbiting Data

Oscar 6				Oscar 7				
Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (June)	Time (GMT)	Longitude of Eq. Crossing °W
12001	1	0119.3	70.3	B	2472	1	0004.7	51.0
12013	2	0019.2	55.2	A	2485	2	0059.0	64.6
12026	3	0114.1	69.0	B	2498	3	0153.3	78.2
12038	4	0014.1	54.0	AX	2510	4	0052.6	63.0
12051	5	0109.0	67.7	B	2523	5	0146.9	76.6
12063	6	0008.9	52.7	A	2535	6	0046.2	61.4
12076	7	0103.9	66.4	B	2548	7	0140.5	75.0
12088	8	0003.8	51.4	A	2560	8	0039.9	59.8
12101	9	0058.7	65.2	B	2573	9	0134.1	73.4
12114	10	0153.7	78.9	A	2585	10	0033.5	58.2
12126	11	0053.6	63.9	BX	2598	11	0127.8	71.8
12139	12	0148.5	77.6	A	2610	12	0027.1	56.6
12151	13	0048.5	62.6	B	2623	13	0121.4	70.2
12164	14	0143.4	76.3	A	2635	14	0020.7	55.0
12176	15	0043.3	61.3	B	2648	15	0115.0	68.6
12189	16	0138.3	75.1	A	2660	16	0014.3	53.4
12201	17	0038.2	60.1	B	2673	17	0108.6	67.0
12214	18	0133.1	73.8	AX	2685	18	0008.0	51.8
12226	19	0033.1	58.8	B	2698	19	0102.2	65.4
12239	20	0128.0	72.5	A	2710	20	0001.6	50.2
12251	21	0027.9	57.5	B	2723	21	0055.9	63.8
12264	22	0122.9	71.2	A	2736	22	0150.1	77.4
12276	23	0022.8	56.2	B	2748	23	0049.5	62.2
12289	24	0117.7	70.0	A	2761	24	0143.8	75.8
12301	25	0017.6	55.0	BX	2773	25	0043.1	60.6
12314	26	0113.3	68.7	A	2786	26	0137.4	74.3
12326	27	0012.5	53.6	B	2798	27	0037.0	59.1
12339	28	0107.5	67.4	A	2811	28	0131.2	72.7
12351	29	0007.5	52.4	B	2823	29	0030.4	57.5
12364	30	0102.4	66.1	A	2836	30	0125.0	71.1

HAM HELP

I'm enrolled in the National Radio Institute's Advanced Course in Communication (rbl57-c438) and I would be glad to help any one in any way possible.

Jonathan F. George WN1UST
25 Dwight Street
Dalton MA 01226

Helpers: Times are tough all over, but remember when you were just starting out? Brighten one of the following's ham day by getting in touch and lending a hand. Preserve the race!

SFC. James F. Widener
229-44-3461
S&M Co USASAFS Box 2034
APO New York 09458
(Augsburg, Germany)

Peter Osroff
2442 East 26 Street
Brooklyn NY 11235
(212) 646-7757

Robert C. Boucher
90 Shawsheen Road
Billerica MA 01866

Robert A. Sorento
503 E. Darby Road
Havertown PA 19083

William Prago
2240 Center Avenue
Fort Lee NJ 07024
(201) 944-2860

Clarence Lowe
2330 Lucas Street
Cayce SC 29033
(803) 796-1177

Helpees: Don't be bashful. Drop a postcard to 73, Ham Help, Peterborough, NH 03458.

INITIAL MADNESS

Blame the Mt. Tom Repeater Association for this — much of it came from their newsletter, "Intermod."

Non-ham readers of 73 (and other ham magazines) struggle through the abbreviations which are so standard to amateurs that few are given a second thought. Try these on and see how you do — most are amateur oriented. 95% or better, take a bow. 90% = well versed. 80% = average. 70% = Novice. 60% = CB.

1. GDO	26. SCR	51. OOT	76. OBS
2. FSK	27. EMF	52. MOS	77. AST
3. RFI	28. PTO	53. AFC	78. CCS
4. TTL	29. SCM	54. RST	79. VAC
5. BPL	30. VOM	55. TVI	80. HFO
6. PEP	31. UHF	56. ITU	81. ROM
7. USB	32. LDE	57. SEC	82. AWA
8. ANL	33. UJT	58. LSD	83. WAC
9. SWL	34. FMT	59. NCS	84. VCO
10. WPM	35. CUL	60. PTT	85. ILS
11. VFO	36. GMT	61. SNR	86. VLF
12. SWR	37. MAH	62. RCC	87. DOT
13. WAS	38. COR	63. MUF	88. RMS
14. ERP	39. BFO	64. VTR	89. EME
15. SET	40. RIT	65. CPS	90. VDC
16. MCW	41. FET	66. ATV	91. UFO
17. RFC	42. LMO	67. VOA	92. CTS
18. CRT	43. STA	68. OEM	93. PRV
19. PIV	44. EEG	69. MMF	94. NBS
20. VOX	45. ALC	70. CGS	95. DSB
21. CAP	46. BCI	71. FCC	96. VXO
22. PLL	47. FAA	72. ORS	97. RTL
23. OTP	48. LSI	73. AGC	98. SAE
24. LED	49. CDI	74. ECO	99. DIP
25. NTS	50. BST	75. TRF	100. CCW

LETTERS

HELP!

I need some assistance. I am an unemployed Disabled Veteran and I am trying to obtain a SSB transceiver capable of working on the Illinois MARS frequencies (7632 MHz, 3311 MHz, and 33Ø9 MHz). As I am unemployed and disabled, I don't have any (or very little) funds to purchase a unit. I do, however, have many VHF units that I can swap. This unit does not have to be totally operational as I can (needless to say) repair it. *Anything* your staff can do to aid me in this search would be greatly appreciated, even if someone sells me a set on faith that I will pay upon gainful employment, or loan me a set until I am able to purchase one. I do request, however, that if you print this appeal, that you don't print my name or call letters. I would attempt to purchase a unit from a commercial house if I were employed and if my credit rating wasn't so horrible from being out of work so long.

(Name and address withheld)
Contact Box 4
73 Magazine

FRENCH LICENSING

Here is some information as requested in your March issue, concerning class privileges and exam requirements in other countries.

Voila for France:

First of all the cost of the examination: It comes altogether to about $26 at today's exchange rates of 4.5 francs for $1. Of this total, 30 Fr. ($6.6) are due for the Post Office's fee for opening a file. The rest is for the exam fee ($20).

There are at present two different classes of licenses in France: One permits the holding of a CW operator ticket (CW exam) which gives full privileges and the use of all radio amateur bands. (French amateurs' bands!)

The second does not require the CW test and is only valid for the VHF bands on phone or any other mode.

Wide band TV requires a special extension of any license.

The technical test is extremely simple and there is not a written exam.

The official does give the exam at the candidate's home in most cases, and if you don't try to kill him, everybody gets "okay" with the "technical examination."

The CW exam is also quite simple. The official sends a written text for about 5 minutes at a speed slower than 10 wpm! The regulation requires 10 wpm copying speed. When I passed the exam 2 years ago, the text (CW) was sent to us 3 times before the final one. The official takes with him the written text as a proof of the exam.

At present, power is limited to 100 W dc, but anything is tolerated.

The annual fees at present are 70 Fr. or about $16 a year.

Although I am a foreigner in this country, I have full privileges and a real French call, F6CVU. This is due to the fact that I have a resident's status here.

Foreigners getting a license under any agreement for a provisional time do have FØ prefixes. And as a general rule all F1 prefixes are only VHF stations.

Here are the French amateurs' band complements. HF: 3.5 to 3.8 MHz (shared with other services, such as Army, Police, etc.); 7 to 7.1 MHz; 14 to 14.35 MHz; 21 to 21.45 MHz; 28 to 29.7 MHz; 50 to 54 MHz (not in region one, but OK for French Guiana, Martinique, etc.). VHF and UHF: 144 to 146 MHz (shared with other services); 430 to 433 MHz (shared with other services); 4345 to 440 MHz (last year this portion was lost by the inaptitude of the French Amateur Radio Club and the weight of the Army here); 1220 to 1260 MHz (shared); 2300 to 2450 MHz (shared and requires a special permit from the Post Office!); 5650 to 5050 (shared); 10000 to 10500 (shared); 24000 to 24500 (shared).

Special attention is given to the following sub bands: 433 to 434.5 MHz; 1215 to 1220 MHz; 1260 to 1300 MHz; 2300 to 2450 MHz (special permit required).

All these frequencies are strictly forbidden and apparently their use endangers one's life (some special aviation services are working these frequencies).

Any official information can be requested from: Direction Des Telecommunications du Reseau International, Immeuble P.T.T., Bercy, 75584 Paris Cedex-12 or from the French Radio Club: R.E.F., 21 Square Trudaine, 75009 Paris, Phone 878 14 49.

And by the way, VHF repeaters are not legal in France!

Jacinto Lirola
21 Rue Lavoisier
67200 Strasbourg
France

WESTERN SAMOA

I have had a license from Western Samoa for many years. Callsign: 5W1AT. Western Samoa will issue licenses to licensed amateurs from foreign countries for a period of one year at the cost of three tala, W.S. A U.S. dollar is worth sixty W.S. cents. The privileges granted are equivalent to the U.S. Extra. Licenses from General (U.S.) on up are accepted as evidence. I don't know what would happen in the case of a Novice, since none has applied as yet. There is no reciprocity between Western Samoa and the U.S. The licenses are granted as a courtesy, and there has been no problem to date. For a W.S. license, send the equivalent of three tala to Mr. E. D. Williams, Director of Post Office and Radio, General Post Office Building, APIA, Western Samoa. Make money orders payable to the Government of Western Samoa.

I hope this information may help you in your compilation.

Jim Jaeger KS6EX and 5W1AT
Pago Pago, Samoa

GREASY KID STUFF

I was just loafing around the house yesterday, and decided I had to get something off my chest. It has been building up for two weeks, since I tuned up on 15m and got hold of a guy out west. From his call I assumed he had been around for some time and he confirmed this by saying he had his

ticket back in '53. After giving him the usual signal report, rig and wx bit, I thought I would give him a little background on myself. So I told him I was 25 years old and operated 80-10m on CW and SSB. Also I told him I had a 2m FM rig and operated simplex and the local repeaters. When I turned it back to him I was promptly informed that 2m FM was greasy kids' stuff and that he had to go QRT for now. He promptly signed off. About four minutes later I heard him calling CQ down frequency.

I don't know if that person reads this magazine but I want to tell him — and the many other people that remind me of him — what I think.

I remember when the big tornado hit Zenia, Ohio. I live about 25 miles north. While a few people were on their lowband rigs trying to fight through the QRM, QRN, QSB and generally some of the worse conditions in years, the real work was going on with the two meter crowd. Ask the people in Zenia what they think of "greasy kids' stuff." Ask the police, the National Guard, the Red Cross and all the other relief workers.

And while you're running your high powered rig to talk to a guy 20 miles away I think I'll use my battery operated 1 Watt rig to do it.

To conclude this I would like to say that I derive most of the pleasure I get from amateur radio from operating on 15m SSB and CW. However, I work every frequency I can to some extent or the other. I find it absurd and detestable to see blind prejudice against any frequency or mode, when they all have their practical and pleasurable aspects.

Gary L. Robinson WB8ROL
Troy OH

GRIPE

Was quite interested in W4AEO's Log Periodic antennas in the March 73. Had occasion to want to squeeze a few more decibels out of a low frequency end of a Log Periodic so I hung a couple of parasitic reflectors at 33% of the free-space-distance behind the last element. It helps.

Also have a gripe to pick with those chaps who think a receiver works better grounded to a water line than independent grounds. In these days of transite water mains, insulated pipe couplings between copper and galvanized pipe and water-pipe grounded electrical equipment, a lot of household and powerline racket can be inductively coupled into the set via the ground linkage. It's much better to use a couple of good grounds in parallel located well away from any buried water lines. Also add a couple of .05 uF 600 volt condensers to shunt exterior power line racket to the ground out at your breaker box following the meter. It keeps the house wiring from feeding it into the antenna, etc.

L. S. Hannibal
Fair Oaks CA

ECUADOR

I am enclosing a picture which I thought might be of interest to you. It was taken with my new 5BWAS, No. 182 issued in August. The picture was taken in our shack and also in the picture is my OM, Joe HC2OM, and our little 19 month old daughter, Diane Renee.

Have been participating in various contests including the annual YL-OM Contest and got about 72,000 points in the phone portion but had bad luck in the CW portion with only 12,900 points. My rotor was stuck toward Europe due to a damaged ring gear (there are no spares in Guayaquil), I had a power outage, and then came a heavy rain with rain static — severe for about 4 hours.

Darleen Magen HC2YL
Guayaquil, Ecuador

SPLIT-SPLITS

Bill Pasternak's article on 15 kHz split repeater channels in the April issue of 73 was of some interest to me since we have been considering for some time the problems of having a repeater 15 kHz above or below our repeater. Clearly, Bill has had more than enough practical experience operating repeaters to understand the problems with split-split channels, but I find a serious error in his explanation of the channel placement. His discussion is based on the misconception that 5 kHz deviation produces a 10 kHz channel. Now it seems simple enough to space 10 kHz channels every 15 kHz leaving a 5 kHz guard channel between each repeater to allow for frequency drift and overmodulation. The whole idea fails because the actual bandwidth of an FM signal is equal to twice the deviation plus twice the highest modulating tone. In commercial service this works out to be the familiar 16 kHz for narrowband FM. Rather than leaving a guard channel between repeaters, there is in fact an overlap of 2 kHz on each side of each channel when the channels are spaced at 15 kHz intervals.

Bill was close to the problem when he said that the WA2ZWP was operated at 4 kHz deviation, which reduced the interference to the other repeaters. What he actually did was reduce his bandwidth to 14 kHz, which removed most of his sideband energy from his adjacent channels. The important point to remember is that there is no guard channel between repeaters as is suggested in the figures in the article. Instead, there is an overlap of 2 kHz on each channel which puts a considerable amount of energy in each adjacent channel.

Split-split repeaters of either the

Continued on page 12

SOCIAL EVENTS

OLD WESTBURY NY
JUNE 1

The Long Island Mobile Amateur Radio Club (LIMARC) will hold an all-electronic flea market and auction on Sunday, June 1 (rain date June 22) from 10 am to 6 pm at the New York Institute of Technology at Route 25A and Whitney Lane, Old Westbury, New York. Auction will begin at 4 pm. Items to be sold include communications equipment, hi-fi, TV, components, test equipment, etc. Admission is $1 for buyers and $2 for sellers. Call-in on 25/85. Refreshments will be available.

WINFIELD PA
JUNE 1

The Twelfth Annual Penn-Central Hamfest will be held by the Williamsport and Milton clubs on Sunday, June 1, at the Union Township Volunteer Fire Co. grounds on Route 15 in Winfield PA. This informal hamfest with indoor and outdoor facilities for contests, auction and flea market, will start at 12 noon. Gate registration $3, XYL and children free, free parking. Talk-in on 3940, 146.13/.73, .37/.97, or .94 MHz.

BURLINGTON KY
JUNE 1

Sunday, June 1 at the Boone County Fairgrounds, Burlington, Kentucky. Located 10 miles south of Cincinnati, Ohio near I-75. Features prizes, indoor exhibits, flea market, refreshments. Tickets: $1.50 advance, $2 at door. Contact: WA8OGS, 6381 Mullen Road, Cincinnati, Ohio 45239.

BROOKLYN NY
JUNE 6

An auction sponsored by Brooklyn College Amateur Radio Society and Radio Society of Greater Brooklyn will be held Friday evening, June 6 at Brooklyn College, Bedford Avenue between Campus Road and Avenue "I", Room 148, Ingersol Extension. Doors open 7:30 for sellers auction starts 8 pm sharp. Admission $1 for non-sellers, $1.50 for sellers. No commission charge.

FLUSHING NY
JUNE 7

The Hall of Science Radio Club will hold its Second Annual Flea Market on Saturday, June 7. The flea market will begin at 10 am. Tickets will be $12 for everyone and we will have several door prizes. Rain date June 8.

GRANITE CITY IL
JUNE 8

The Egyptian Radio Club Inc. Hamfest will be held on Sunday, June 8, 1975 located at the Clubhouse ¼ mile south of Old Chain of Rocks Canal Bridge. Prizes, swappers row, games for kiddies, ladies' white elephant sale and Bingo. Admission free. Talk-in on 146.16/146.76.

MANASSAS VA
JUNE 8

Ole Virginia Hams ARC, Inc. will sponsor a Hamfest Sunday, June 8, 1975 in Manassas, Virginia at the Prince William County Fairground, 1/2 mile south of Manassas on Route 234. Indoor and outdoor exhibit bldgs, FM clinic, 2 YL programs, ECARS, door prizes and refreshments. Advance reg. $1.50, at gate $2.50, children under 12 – free. Tailgating $2 per space. For Advance reg write to Ole Virginia Hams ARC, Inc., c/o Tim Wayne WA4GVX, 1708 Sharp Drive, Woodbridge VA 22191. Talk-in on 146.37–146.97, 146.94 Simplex, 3.955 MHz.

ANDERSON IN
JUNE 8

The Madison County Amateur Radio Club in Anderson, Ind., will hold a Hamfest on June 8, 1975. A free fleamarket, auction, displays and prizes will be offered. The Hamfest will be at the Old Linwood School, north of Anderson on S. Road 9 and 600 N. Time: 9 am to 4 pm. Call-in on 22-82 WR9ACI.

WILLOW SPRINGS IL
JUNE 8

Six Meter Club of Chicago, Inc., 18th Annual Hamfest, Sunday, June 8, 1975. Southwest of Chicago at Sante Fe Park 91st and Wolf Road, Willow Springs IL. Advance reg. $1.50, at the gate $2.00. Large swap row, color TV, and many other goodies, picnic grounds, plenty of parking space, refreshments. Advance tickets from Val Hellwig K9ZWV, 3420 South 60th Court, Cicero IL 60650 or any club member. Talk-in on 146.94 FM or WR9ABC 37-97(PL2A).

DES MOINES IA
JUNE 8

The Des Moines Radio Amateur Association invites you to participate in the Des Moines Hawkeye Hamfest, the largest hamfest in Iowa. Located at Iowa State Fairgrounds in Des Moines. It will be held on Sunday, June 8, 1975 at 8:00 am to 6:00 pm CDST. For more information contact Des Moines Radio Amateur Association, Box 88, Des Moines IA 50301.

JEFFERSON CITY MO
JUNE 8

The Missouri Single Sideband Net Annual Picnic will be held at the shelter house of Memorial Park in Jefferson City, Missouri, June 8, 1975. Activities begin 8 am – swap tables – door prizes – carry-in dinner – refreshments provided – all hams welcome. Direct inquiries to any MOSSB net control 3.963 MHz, WBQFND net manager. Talk-in on 146.94 and 3.963.

TRAPPE MD
JUNE 8

Eastern Shore of Maryland Hamfest – sponsored by The Easton Amateur Radio Club on June 8, 1975 from 10 am - 4 pm, rain or shine. Only 35 minutes south of the Bay Bridge, one block off Rt. 50, in Frappe MD, between Easton and Cambridge at the old Trappe Elementary School on Main St. Talk-in on 146.52, 94, and 146.445/147.045 rept. in Cambridge. Tables, food, drinks, ladies program, prizes and plenty of room for tailgaters. Admission $2 or $4 for tailgaters. Contact K3RUQ.

ORLANDO FL
JUN 14-15

Orlando Hamfest at Exposition Park.

AKRON OH
JUNE 15

The Goodyear Amateur Radio Club WA8UXP (Akron) will hold its 8th Annual Fathers Day (Hamfest) Picnic on June 15, 1975 at Wingfoot Lake Park located east of Akron, Ohio, one mile west of Suffield, Ohio, on County Road #87 and near County Road #43. Join us for an enjoyable day of entertainment, swap and shop, prizes every hour, refreshments, displays, huge flea market, picnic tables and children's games available. $2.00 family admission prepaid or $2.50 at the gate. For details, map, tickets and program write Floyd T. Gilbert WB8ALK, 1976 Newdale Avenue, Akron OH 44320.

BALTIMORE MD
JUNE 15

The Maryland Mobileers Amateur Radio Club, Inc. will hold its 5th Annual Hamfest, RAIN or SHINE, June 15, 1975 at the Anne Arundel Community College. The college is approximately 12 miles south of Baltimore just off Route 2. Registration $2, tailgating $2. Talk-in 10/70, 16/76, 94, 52 and others.

ROME NY
JUNE 22

The Rome Radio Club sponsors its 23rd consecutive "Ham Family Day" on Sunday June 22, 1975 at Beck's Grove, 10 miles west of Rome, New York. This is a true ham-family event with a complete program for all ages — technical talks, meetings, flea market, contests, equipment displays, ladies' and children's fun programs. Advance reservations: Adults $7.25, children under 12 S4.00, under 6 free. Tickets at the gate without dinner: adults $2.50, children free. Send your reservation to the Rome Radio Club, Box 721, Rome, New York 13440.

JACKSONVILLE IL
JUNE 29

The Jacksonville Area Amateur Radio Club will hold their 11th Annual Hamfest, Sunday June 29, 1975 at the Morgan County Fairgrounds as in previous years. A large trading area available for rain or shine. Talk-in via WR9ACS or .16/.76 and .94 direct.

HEAR PROSE SPEAK
(or)
"HERE, PROSE . . . SPEAK!"

Spend the Fabulous Fourth of July weekend at the 47th annual Atlanta Ham Radio Festival and ARRL Georgia State Convention. Center of activity will be the Royal Coach Motor Inn, I-75 North, July 5th and 6th.

Highlight of the Festival will be the Saturday night banquet with Keynote Speaker, FCC's A. Prose Walker whose topic will be, "Docket 20282 — Restructuring."

Activities cover all phases of amateur radio including ARRL Forum, FCC examinations, biggest flea market and manufacturer's display in the south, special events for XYLs and Junior OPs, Sunday afternoon grand prize drawing, MARS meetings, technical programs, something of interest to every ham and his family.

Pre-registration — $2 per person or $4 per family ($3 or $5 at hamfest). Special hamfest motel rates $16 single and $21 double (children under 13 free).

For more info write: Atlanta Ham Radio Festival, P.O. Box 76553, Atlanta, Georgia 30328.

MAPLE RIDGE BC
JULY 11-13

Maple Ridge Hamfest is being held on July 11, 12 and 13 at the Maple Ridge Fairgrounds approximately 30 miles east of the city of Vancouver on the north side of the Fraser River. The hamfest includes: Technical seminars and displays; contests for the women and children, as well as the OMs; a hidden transmitter hunt; mobile judging; technical IQ quiz; home brew equipment contest; commercial displays; two meter home brew antenna contest; Saturday evening meal. Registration: At the door, $3.00 no meal, $7.00 with Saturday meal. Preregistration available for $6.00, cutoff date June 30. Overnight parking for trailers and campers plus spaces for tents available for $2.00, but no hook-ups. VE7MRC will be monitoring 146.94, 146.76, 146.79, 147.33 and 3970, 3755 for talk-in purposes from 1600 July 11 on.

John Gearhart WA0AQO
1408 Dawn Drive
Columbia MO 65201

REVISIONS FOR "SCANNING WITH A SYNTHESIZER"
(April, 1975, pages 23-36)

Page 25 — Fig. 2. Ground pin 6 of IC10.

Page 26 — Fig. 3. Connect pin 5 of IC31 to Vcc; connect pin 12 of IC31 to ground.

Page 32 — Fig. 6. See revised version.

Page 33 — Interface. The sentence, "Hex buffers are used as shown in Fig. 6," should read, "Fig. 6 shows how AND gates are used as buffers."

Page 36 — Parts List. Interface: IC40, IC41, IC42 — 7408.

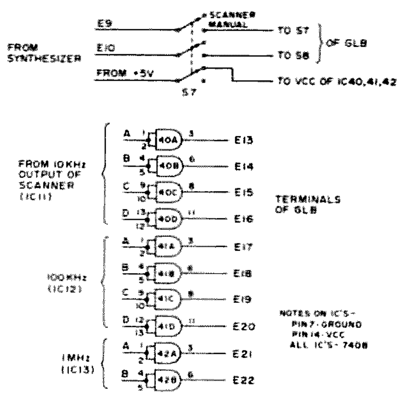


Fig. 6 (revised).

CHARLESTON SC
JULY 12-13

The Charles Town Hamfest will be held on July 12-13, 1975 in Charleston, South Carolina. For more information write: P.O. Box 12502, Charleston SC 29412.

Never Say Die from page 3

paving the way, but the rules make their work slow and painful. There are stations you can work and even get a printed out QSL — and no one is there! The "operator" is off at work, but his station still is available to communicate.

If we can put a halt to this escalation of the rules, we will all benefit in the long run. It's up to you. Are you going to write the FCC this week?

AUTOMATIC IDENTIFICATION

The recent FCC docket ushering in automatic identification of just about all transmitters except amateur may have some valuable fallout for us.

Once inexpensive ICs are available for encoding identification, it should be possible to have your call precede each transmission, sent in a brief burp. By using a sharp audio filter on the receiver to feed this burp into a decoder, but not into the speaker output, you wouldn't hear the identification at all. A decoder could then translate the burp into the callsign of the transmitting station and present it on a set of LEDs so you would have the call of any station talking to you right on the front of your rig. Hell, why not add the name, too? It would require perhaps seven readouts for the call and another seven for a handle.

Let's see what we can do to get some experimentation going on this and some articles on hardware into 73 Magazine . . . and please, don't anyone dare to petition the FCC to make this a rule.

One serious drawback: I can see bitter opposition from the substantial group dedicated to self-righteous and indignant demands that the breaker identify himself immediately — this

Continued on page 16

LETTERS from page 9

ARRL plan or the California plan will require that we narrow band our equipment in a way similar to the narrowbanding of commercial equipment a decade ago. It will not be necessary for everyone to buy expensive filters for their receivers unless they want to work a distant repeater on a channel adjacent to a strong local repeater. It will be very important that everyone adjust their equipment to 4 kHz or less, which will keep them from keying up the adjacent repeaters unintentionally, and it would be nice if everyone could stay within 500 Hz of the channel center. All of this leads to the second misunderstanding, that the repeater is the cause of the problems. It is of little importance how the repeater is adjusted, since it is supposed to provide local coverage only. The burden falls instead on the users, who must maintain their equipment to some rather high standards to keep from interfering with adjacent repeaters — and these standards cannot be met by adjusting by ear.

I see two alternatives to this problem. I expect that there will be much more tone access in the future because repeaters are hard to monitor when they are frequently keyed up by nuisance signals. Even with all the split-split channels allocated, the populated areas of the country will have fully used up the spectrum on 2 meters within the next three years. I agree with Bill that the long term solution is to develop 6, 220, 450 and eventually 1215 MHz. To that end, we will shortly operate repeaters on 6 and 450. See you there.

Robert W. Condon K1WUK
Shrewsbury MA

Continued on page 14

NEW PRODUCTS

INEXPENSIVE FM FREQ STANDARD

Magtech Engineering has come up with a nifty answer to the need for a frequency generator to standardize repeaters and FM transceivers. The FM-146 is a little blue box (don't get nervous Ma Bell) which needs +12 V and a couple of short antennas . . . everything else is done by ICs.

Anyone who needs to have a digital wristwatch which is accurate to the second will want to have his rig or repeater accurate to at least 10 Hz, right? The FM-146 has a crystal oscillator at 3 MHz which is then divided down to 1 MHz and harmonicked out to enable you to zero it in with WWV on any frequency out to 15 MHz. There is a small trimmer capacitor for this function. Another chain divides the 3 MHz down to 30 kHz (by 100) and this too is made rich in harmonics . . . then it is put through a high pass filter. The result is a lot of 30 kHz signals in the 146 MHz band, radiated by the small antenna on the FM-146, allowing FM rigs to be tuned up right on channel for every 30 kHz frequency — and that does it for both transmit and receive.

Simplest thing in the world to use . . . put in the power and start tweaking your capacitors. At $60 this has to be one of the better bargains in amateur radio . . . imagine, accuracy as great as 10 Hz at 146,000,000 Hz . . . which is ten to the minus what? Drop 'em a note for further details, which you really don't need, but which you may want if you prefer buying things in two steps instead of one . . . Magtech Engineering, Box 21979, San José CA 95151.

THE HEATH SCOPE

The 4530 Heath single-trace oscilloscope features TV coupling, DC-10 MHz bandwidth and wide-band calibrated X-channel input, making it a versatile, easy-to-use scope for the service technician and a good general purpose scope for the ham.

The 4530 is one of the few single-trace scopes with two input channels. The Y-input has a maximum sensitivity of 10 mV with an 11-position attenuator. For true X-Y operation, a calibrated X-input is provided with maximum sensitivity of 20 mV. Its calibrated 3-position attenuator can be switched through three ac or dc ranges from 20 mV/cm to 2 V/cm.

High or low frequency waveforms are no problem since the 4530's wide range of time bases can be switched from 200 ms/cm to 200 ns/cm. Any sweep speed can be magnified five times.

Trigger circuits are digitally controlled, requiring only a level control and a slope switch. Signals can be dc coupled, ac coupled or TV coupled to the trigger circuits. In the TV trigger coupling mode, the 4530 can easily be triggered on the vertical or horizontal component in a complex TV signal.

The 4530 is available in kit or assembled versions. The Heathkit IO-4530 is priced at $299.95. The factory assembled and calibrated SO-4530 is $420.00. For more information, contact the Heath Company, Benton Harbor MI 49022.

LETTERS from page 12

RUDE AND FOOLISH

I read with great interest the article by WN7KUD, 73 Magazine February 1975. A biographical piece about certain radio amateurs and their boorish behavior.

Regrettably, I, too, have had personal experiences of rude and foolish behavior on 20m SSB (it's DX time and get off my frequency) and 2m VHF (this is our repeater and who the hell do you think you are?), usually blurted over the ether by the "older" and "Big John" radio amateurs.

Further, such activities as "closed" repeaters, regrettably frequent use of words such as "jerk" and "wap," constant criticism of CB operators, and a boorish high mindedness is, to me, far too prevalent within the American Amateur Radio fraternity.

It would seem that the recently published docket from the FCC is one final attempt to responsibly organize the U.S. Amateur Radio fraternity without kow-towing to the ARRL nor to the whims of amateur radio's "Big Guns."

John Anthony G3NDY/W2
Croton-on-Hudson NY

THINKING METRIC

Will you please (for ' sake) stop the idiot practice of printing article dimensions in both the U.S. and metric systems? What kind of imbeciles do you think your readers are that they must be given the same conversion information many times per page, page after page, month after month? Shucks ( ), I'm 58+ years (704.194 months) old and learned the metric/English conversions when in the sixth grade, which makes it about 46 years (16,802.25 days) ago, probably some years before you were born. Only supercilious egotists would take it upon themselves to teach a technical audience an utterly simple set of conversions that they already know, then do so in a spoon feeding manner suited only to Sesame Street TV for pre-school children. Every time I read one of those "about a foot and a half (45.72cm) long" asininities my teeth ache as if a large rasp had been dragged across them.

Besides, if there is anything I can't stand it's sloppy workmanship. The December issue gave a score of linear dimensions without their metric equivalents (pp 42, 44, 45, 84 & 108), gave temperatures in Fahrenheit on page 28 without telling us what they were in centigrade, and told us on page 45 how to calibrate an anemometer in miles per hour (horrors, how many kilometers are those old things?). This last shapes up as a nice coming battle for you "let's convert" nuts, by the way. I'm a private pilot as well as a ham, and while you metric buffs are shouting "kilometers" in one ear and the air controllers, AOPA and FAA are yelling "knots and nautical miles" in the other I am gazing down at a beautiful land nearly criss-crossed and checkered from coast to coast with varied patterns of roads, fences and fields of grain all laid out in statute miles (5,280 ft. each). Ah, me.

One more dig and a suggestion. I'm sorry to tell you the bad news, but mindless repetition of precise English /metric conversions is exactly the wrong approach to the real problem, which is to get people to "think in metric". You're trying to teach code by "dash-dash-dot-dash" instead of by "dah-dah-di-dah". If you must continue the metric crusade and role of educator, I suggest that if you will print only the metric figures, and carry them out only to the last important significant digit, we readers will be "thinking in metric" in no time. Let's try an example.

On page 89, December issue, we find ". . . a lot of us are putting up with a 40m inverted vee 7.62m (25'0) high in the middle and 3.05 (10') off the ground at the ends." Utterly absurd, teeth-grinding reading, authored (or edited) carefully to be false. The vees are 40 meter (band) antennas, not 40m antennas, and it is unlikely that even one of them will measure 7.62m, which implies a tolerance of ±.005m, high at the middle and 3.05m to the same tolerance at both ends.

Since we all know that a meter is a little over three feet, let's try instead ". . .a lot of us are putting up with a 40 meter inverted vee less than 10m high in the middle and only 3m or so off the ground at the ends". Voila, we can Think Metric already!!

Jim Bowles
Ukiah, California

WE BUY IT OR WE DON'T

May I say a word of warning regarding the proposed changes?

Current regulation can't be all that bad or we wouldn't still be enjoying the pleasures of amateur radio. If we start nitpicking the rules just to get our petty desires incorporated, then sure as heck we will get burned by some changes we don't like (some we haven't even heard of yet).

Either we buy Docket 20282 in its entirety or we don't buy it.

I for one don't buy it.

John M. Marshall WA7YCY
Gresham, Oregon

DON'T CHANGE

73 is the only ham magazine I read now, outside of an occasional copy of QST. Don't change a thing. I especially enjoy the editorials, solid state news, and Looking West. (I do believe many of the problems and solutions in the West column will one day be occurring here in the midwest, also.)

. . .P. Scott Smith WB9JSE
7723 W. Bender Avenue
Milwaukee WI 53218

CW ALIVE AND WELL

I was reading your "GRRReen" column from the December '74 issue and was intrigued by your comment that "(the military) seems to have little interest in code any longer." As a military radio operator, I can assure you that CW is far from "dead" in the military. In the 10th Special Forces Group, we use CW almost exclusively for our long-haul communications. We have found that at long distances, using low power, CW is the fastest, most accurate, most jam resistant means of communicating.

Sgt. Hartley J. Gardner WA1KNG
Fort Devens MA 01433

FANTASTIC

I think your magazine is fantastic. Although I am not a ham (yet) I am trying to keep up with the technical advances of radio.

From just the amateur's view, over a year's time (according to the annual index) you have had an article on every phase of amateur radio. 73 is the best ham magazine I have come across including QST, CQ and Ham Radio.

Johnnie David Twine
APO New York

Continued on page 170

Caveat Emptor?

PRICE — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

THE 3RD ANNUAL Des Moines Hawkeye Hamfest will be held on Sunday, June 8, 1975 at the Iowa State Fairgrounds. Plenty of free parking. Flea market, covered display booths available, small charge; open arena, no charge. Dealer displays, prizes, XYL activities. Camping available, small charge. Registration $1.50 advance/$2.00 at gate. Write Des Moines Radio Amateur Association, Box 88, Des Moines IA 50301.

MONTREAL HAMFEST 75, Aug 3, MacDonald College Farm, Ste. Anne de Bellevue, prizes, giant fleamarket, technical sessions, family fun $2.50/adult. Info contact VE2RM, Box 201, PointeClaire-Dorval, Quebec H9R 4N9.

COMPLETE QSL Catalog! Hundreds of cuts, stock and ink samples. Ten sample QSLs 25¢. Corneilson's Quality QSLs, 321 Warren Street, N. Babylon NY 11704.

ANTIQUE RADIO BUFFS. Do you need a schematic for your radio? For information send SASE showing make and model number. Joseph C. Crockett K3KUL, 762 S. Gulph Road, King of Prussia PA 19406.

WANTED — Make, Model and Serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma WA 98466.

RTTY . . . Model MRB-TU Terminal Unit. Features: automatic shift selection — delayed autostart — all solid state — no toroids — operates on 12 V dc — compact size — guaranteed. Assembled board with motor relay, less loop supply . . . $60.00 PPD. Less relay . . . $57.00 PPD. G&M Electronics, P.O. Box 22, West Carrollton, Ohio 45449.

ELECTRONIC PRINTING Calculator — Unicom Model 1011P — Brand new — still in box. Original cost $195. Received as gift. Want to trade for any kind of Ham Gear. PAT, P.O. Box 314, Shiremanstown, PA 17011.

RADIO ARCHIVES, amateur ANECDOTES (then & now) solicited for proposed (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 fourth St. N., Mpls., Mn. 55412.

WANTED: TRI-EX TOWER Model HZR471N (71' rotating tower) galvanized and complete with rotating rings. W1 WL — Arthur C. Egan, 56 Stilson Avenue, Northampton MA 01060, 413-586-4244.

SELL: Kenwood T-599 & R-599 w/converters. $275 ea. or $500 both. Jesse Newton, c/o Ben Byron MHP, Box 10, McDonald, TN 37353.

SWAN, CushCraft at prices I dare not publish. Call or write WØNGS, Bob Smith Electronics, 1226 9th Avenue North, Fort Dodge IA 50501. (515) 576-3886.

RTTY FOR SALE: Model 15-19 friction-feed conversion it, $13.00, Model 28 style table-stand, $25.00, Model 15-19 printer bases, $7.00, Model 28ASR motors, $25.00. Model 28 printers, gearshifts, cabinets, parts, accessories. SASE for complete list. Motorola T53GKT, Mint, $225.00. Antique tubes. Lawrence R. Pfleger, P.O. Box 21956, Milwaukee WI 53221.

FREQUENCY COUNTERS. 5 digit readout expands to 8. Range 10 kHz to 250 MHz $159.95. Free flyer. LAD Systems 5178 Bellaire, Oak Forest IL 60452.

HEATHKIT HD-15 phone patch, mint, $30; Westinghouse 3" reel tape recorder and 4 tapes, needs some work, $20. Dick Morofsky, Box 11, Nemacolin PA 15351.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945-75. Indispensable!)

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester NY 14612.

WANTED: Navy surplus AS-390/SRC or AT-150/SRC 200-400 MHz antenna. Ed Alves WN6BJD, 305 E. Acorn Cir., Monrovia CA 91016.

ANELEX HIGH speed printer, model 4.5-80-DD 80 column, complete with P.S. and driver cards SASE for details. Best offer. Mike Vande Voort, Route 1, Leighton IA 50143. 515 626-3195.

PHOTOSTAMPS make QSLs distinctive. 100 unique stamp-size photos $3.00 QUICK! Gummed. Perforated. Made from your photo, returned unharmed. KENDALL BAKER, 5342 LaLuna, LaPalma CA 90620.

COLLINS R-390 Receiver. Completely realigned and in mint condition. First $500 plus shipping will take. D. M. Haworth, 1407 W. B, North Platte, NB 69101.

INSTRUMENTATION Recording Tape, precision, one inch, 10/14 inch reels, Scotch, Memorex, bottom prices. SASE details, WA6ZTN Radio Club, 34022 Blue Lantern, Dana Point CA 92629.

Never Say Die from page 11

would spoil their fun. Nuts to them, let's get them back on CB where they belong and get some ID gear into article form — and have some fun.

BUMPER STICKERS

As you all know, the readers of 73 are a particularly creative lot since the entire magazine, except for the editorials, is written by them. But their fertile minds do not stop there. They continuously suggest other interesting projects to us. Most of these we do not have the time and manpower to carry out, tempting as they be, but Gordon Bello WA1JWQ came up with one that was both simple to produce and something really helpful for ham PR: a bright bumper sticker with a good slogan. They are 50¢ apiece from 73. You'll find an ad elsewhere in this issue.

. . . W2NSD/1

Edwin K. Cole W7IDF
P.O. Box 3
Vashon WA 98070

Me Friend

In round figures there are 150,000 hams whose licenses are not printed in English, and when we hear their calls most of us automatically lean forward and pay closer attention. Nothing much else happens. If a contact is made it is usually brief, stereotyped and unproductive in terms of minds meeting. Very likely data on a QSL card will be the consequential evidence of communication. Lack of a common language is effective insulation.

Some DX stations will exchange reports with you so smoothly you may never guess you've heard all the English they know. A routine encounter and then they vanish like the Cheshire cat. Now and then a few will venture farther into our idiomatic jungle and with informative diffidence inquire about the weather, our equipment, and perhaps family status – nervously hoping for a reply they can translate. Failure to compliment and encourage these adventurers is, sad to say, rather common. English is a tricky language to learn from the outside, more difficult than those of us who were born to it generally believe. A foreigner struggling with English needs all the help he can get.

A minuscule number of foreign operators will manage our language as well as you or I do, but for these gentlemen (and ladies) simple attention to the courtesies of conversation is sufficient acknowledgement. They know their proficiency, and *noblesse oblige* – it is for them to encourage us.

It is a fact that we need encouragement for we are notoriously reluctant to learn foreign languages. Perhaps we lived too much of our national history under the cozy illusion that our own resources and opportunities were inexhaustible. Today insularity makes less sense and attitudes are changing. Radio amateurs are a special group, being routinely in one-to-one contact with our foreign colleagues, so I think we have a particular responsibility to improve communications, and I don't mean improving signal-to-noise ratios.

QSO's where language is more barrier than conduit are about as meaningful as hat-tipping by Edwardian types who meet and pass on a busy street. Common interests go undiscovered and potential friendships are just missed opportunities. Cooperative endeavors and productive problem-solving are blocked, and man's segregation by national boundaries is mutely emphasized. Despite the marvelous electronic overriding of oceans, politics and prejudice, it's just hello and goodbye. A sad and curious folly when, after all, communication's the name of our game.

Foreign language study has had a poor press in this country. I remember that in high school the consensus among my peers put down languages as even more pointless and difficult than algebra – a harsh verdict. We noticed that the girls customarily outclassed us in both subjects and saw this as confirmation of our judgment. Soon the course of history made clear how foolish

"pointless" was, but I think "difficult" is alive and well and doing harm.

True, a language is an evolved tool for the exchange of ideas and must be complex. To qualify it needs a vast dynamic range to sing for the poet, bark for the drill sergeant, serve science with accuracy and resonate for trial lawyers awash in eloquence. It must provide a lexicon of rhetoric for politicians and a thesaurus of ambiguities for diplomats.

"Even if you do learn correct English, who are you going to talk it to?"

Clearly no language can be easy to master, but mastery is beyond our needs.

Addressing a pride of professors of English, Clarence Darrow remarked, "Even if you do learn to speak correct English, who are you going to talk it to?" The humor is apposite, and it applies to any language. Simple speech suffices. "Me friend" is the big message.

The vocabulary of any ten year old schoolboy in Wolfsburg would put to shame my modest inventory of German, and yet I wouldn't take a new VW for the fun I've had laying on busted Deutsch. The warm response was really no surprise, but as more "D" calls were logged, and new friends discovered among erstwhile enemies, a splinter of Rhineland steel in the left knee seemed to lose its edge. I would like to think that new generations, less burdened by historical tragedy, will waste less time. International discourse is the key, and we have the means.

The first attempt in a foreign tongue is like standing with one foot on the warm sand and testing the ocean temperature with the other, except for one thing – that initial chill is missing. Warm encouragement is the rule, and it doesn't matter in which language you are experimenting. Russians are especially swift to respond – behind that funny looking thirty-three letter Cyrillian alphabet you will find smiles and hospitality.

Some years ago, when the Kremlin and the White House were not on the friendliest of terms, a trip across Siberia was planned for our daughter, en route to school in England. Prior to her departure I made an all-out effort with a phrase book and a dictionary to contact Russian hams for any useful information. UAØGF, John Glushin, coped patiently with my sweating and stammering and promptly sent us a welcoming letter, helpful and reassuring – carefully typed in English. Similar ventures in Japanese and Spanish were comparably rewarding: cordiality and encouragement invariably, and often more than that. As if by remote control doors open from the ham shack to the home, to the people and their country. Given the state of our world, could a modest effort be better repaid?

Getting started in a foreign tongue is probably easier than you think. From my own experience as a high school dropout past middle age I can assure you that mental sparkle is not a prerequisite. Fortunately we have useful aids available cheaply, and let's start with Dover Publications. Please write to them at 180 Varick Street, New York, 10014, for their "Catalogue of Books and Records in All Fields." It's a treasury of well-bound paperbacks at prices old men remember, and fascinating just to read. The language section we are concerned with is a small part of the catalogue, which includes everything from Walter's "Traveling Wave Antennas" and Lebedev's "Special Functions" to an exciting treatise on "Mad Inventions" – which describes such patented triumphs as an edible tie pin, a balloon propelled by indentured vultures and a locket for the safe-keeping of used chewing gum. In between, Architecture, Folklore, Cookbooks and almost everything else. I first wrote to them for this catalogue some years ago, and it befell that I've been hooked on their books ever since. That's what befell.

"The Helpful Interpreter: Ideal for Collectors, Hobbyists, Lonelies, Pen-Friends, Salesmen."

Presently Dover has in print six classifications of foreign language aids, and the "Say it In" and "Essential Grammar" series probably are the most useful to hams in a band-scanning mood. From ninety five cents to a buck and a half. Buy some just to keep these people in business and I will be your friend.

Carl Sletten W1YLU is even more deserving of our support. Since 1970 Carl

has been offering us help over the language barrier with reel-to-reel, cassettes and texts in a series he calls "Foreign Language QSO's." His faithfulness in supplying a tiny market with high quality products qualifies him for some kind of award, but I hope instead that he gets what he would prefer – expressions of interest, and orders, from the amateur fraternity. In a recent letter he remarked, "This is a good cause in terms of preparation for the big cultural collisions in the future as well as for the satisfaction it brings." We're lucky he feels that way about doing a job that requires a special talent, determination and forward-biased optimism.

Friendly peoples rarely wage war. Isolation blocks friendship. Communication ends isolation.

Years of creative labor turning out specialized tapes and texts with minimal financial return suggests a kind of free-wheeling idealism, but Carl's products are truly practical and efficient tools. They work. But not unless we buy them and get busy.

The following is excerpted from one of his booklets: "There is no doubt international goodwill is won by our efforts to work at the languages of other countries . . . anyone who has been able to switch languages with a struggling English speaker knows the immediate friendliness and confidence that results . . . conversational ability lifts a curtain on a whole new world . . ."

At present texts and tapes are available for German, Spanish and Japanese. An Italian text has just been finished and Carl is working now on Portuguese. French will be offered if enough of us write and ask for it. A postcard to: Foreign Language QSO's, Post Office Box 53, Acton, Massachusetts 01720, will bring you a price list and greetings from a ham who is doing something for amateur radio.

Carl's goal is, I think, to lead us gently into learning another language as we ride our hobby. However, two other hams, DL1CU and OH2SQ, heard a different drum and brought out an instant-communication booklet in which typical QSO's in English are repeated in seven other European languages. In addition, comments and questions we use most often and technical terms are listed first in English and then French, Spanish, German, Swedish, Finnish, Serbo-Croat (Yugoslavian) and Russian. In contrast to Carl Sletten's approach, DL1CU's is an end-run around the language barrier for a quick score. But I think he would prefer a different metaphor: a push to get your motor started. By the way, YU1AO made an impressive contribution to the Yugoslavian and Russian sections by ingeniously replacing the Cyrillian alphabet with Latin characters. I don't know enough to say whether this was a good or bad thing to do, but it must have required kilos of smarts and pounds of patience.

At this point I must confess I can't tell you where to get KL1CU's booklet or how much it costs. I ordered my copy from Germany three or four years ago, and I don't remember how much I paid for it but I do recall thinking it was a bargain. Printed in the front is "4th Edition, DL1CU, Box 585, Stuttgart, Germany". Two months ago I wrote to that address but there was no reply, and I wrote again with the same result. A letter to the D.A.R.C. may bring results as I think I first came across the booklet in an advertisement in the German ham magazine "DL-QTC." I really doubt it's out of print and when I find out more I'll pass the word on to Wayne for printing in 73.

Comes now from Austria Christian Zangerl ex-OE9CZI, mit freundlichsten Grüszen and a number of publications. Christian lives in Dornbirn, a charming town in the western part of the country, where he turns the Alpine air into energy and spends thirty hours daily running a printing press, writing letters and thinking up things to publish. This really doesn't keep him busy so he is also turning out tapes. No way has been found to calm Christian, and if you correspond with him I think you will recognize in his uniquely antic communications (I don't really know how to put this) something of the inner fireworks and post-liftoff accelera-

tion characteristic of the publisher of this magazine.

A couple of years ago I fell into the Zangerl net when I sent for his "Radio-amateur's Vocabulary," a 4,000 word German-English dictionary which I found very useful. By January of this year Christian had located 3,500 more words and a new edition is now ready. It's still right-hand drive, with the German words first, but I found that having to dig around for the English before I could find the German equivalent usually adds a few new German words to the brain bank. Christian doesn't readily come to a stop, so a coda of miscellaneous tables is appended like the tail of a comet. Buck and a half for the 4,000 word dictionary and three dollars for the expanded version.

For those of you already into European languages the Dornbirn "Funk Wörterbuch" (from the French side, "Vocabulaire TSF") could be a kind of self-propelling prime mover, being a double-barreled dictionary of radio and television terms in German-French and then French-German. Tacked to the back is a list of handy phrases for technicians (preferez-vous le vin rouge ou blanc?), also a couple of crossword puzzles and a photo of OM Christian. The same format is available in German-Italian and includes a "Tourist Guide."

Next is "The Helpful Interpreter," described as "Ideal for Collectors, Hobbyists, Lonelies, Pen-friends, Salesmen." The first half is a collection of comments and questions in English, then French, then German. "It is very costly today to stay in a new house after being married, yes, I know." "I am a lonely heart." "No, I don't cook. That's for women." "Would it be possible to stay in the household of your parents later on?" (Why didn't I think of that?) "I have been punished only once by police." When the moon was full my wife and I used to watch Johnny Carson – if Dick Cavett wasn't on – then we fell into the enjoyment of taking turns reading aloud from "The Helpful Interpreter." Yes, and that is not a quote from Christian's book. Which is two bucks or nine IRC's.

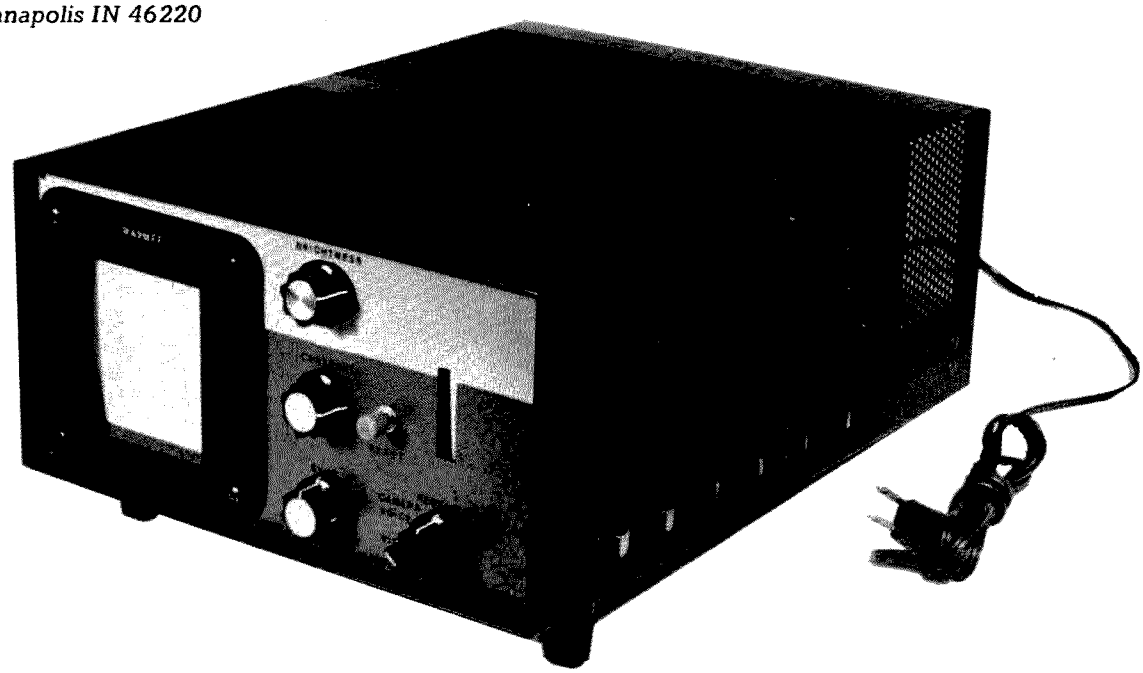
Write to ex-OE9CZI at: Nachbauerstr. 28, A-6850, Dornbirn 1, Austria. Write in any language; Christian is the municipal interpreter. Incidentally, for you W6 swingers he also offers "Pleasure With Pussycats" for the same price as the one above. Christian loves cats. Specify German or English.

It's true that for hams the airwaves provide a language lab and make it easy to get a foot up, but for some of us learning another language is far easier in a classroom. Professional guidance, a syllabus and the company of other aspirants combine in such a way that the total advantage seems greater than the sum of the parts. If you agree and you're not working a swing shift then check with your local school board, and probably you will find that adult-education evening classes are available in several languages. Fees are nominal. And if Carl Sletten and Dover are helping you at home, so much the better. Whatever the means, it's really only a matter of getting started. As an ancient Chinese aphorism puts it: "Journey of a thousand miles begins with release of handbrake."

Finally, let me restate the message in three sentences. Friendly peoples rarely wage war. Isolation blocks friendship. Communication ends isolation.

. . . W7IDF

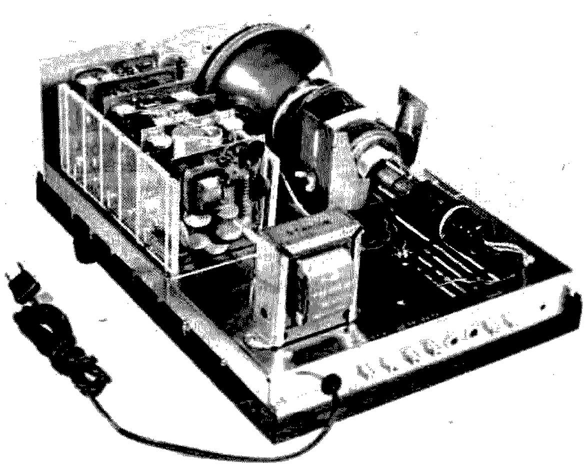
Larry Pryor WA9MFF
5940 Carrollton Avenue
Indianapolis IN 46220



HOMEBREW THIS SSTV MONITOR

This article contains some information that may be useful to someone building an SSTV monitor. It is not a new design, but rather several monitors rolled into one.

I had a lot of fun building the monitor. It took about nine months from start to finish. That means I pretested each circuit, and modified it as I went along so that I knew just what parts it really took to get it to work. When I thought I had a rock solid circuit, I began laying out my PC boards.



Rear view.

Choosing The Tube and Chassis

I had a 5FP7 CRT so I knew I was going to use that tube. At that time a 5FP7 or any other P7 tube was hard for me to locate. I had seen many SSTV monitors at hamfests. While they were original in circuit design and worked very well, they did not appeal to me as a decorative piece of gear. So, if nothing else, I was going to make my monitor look good. Or try to. See Figures 1 and 2, for the monitor and power supply schematics.

I have the Drake T4X, R4A and MS speaker, so I looked into the possibility of using a Drake cabinet. The only factor I had to consider was the size of the CRT. So I got my rule out and did some measuring. I was in luck. The Drake TR4 cabinet was just the right size. If I had chosen a 17.78cm (7") tube, I would not have chosen the Drake cabinet. A cabinet for this tube is a SB-202 Heath Kit cabinet. Anyone who has seen Don Miller's W9NTP monitor at a hamfest

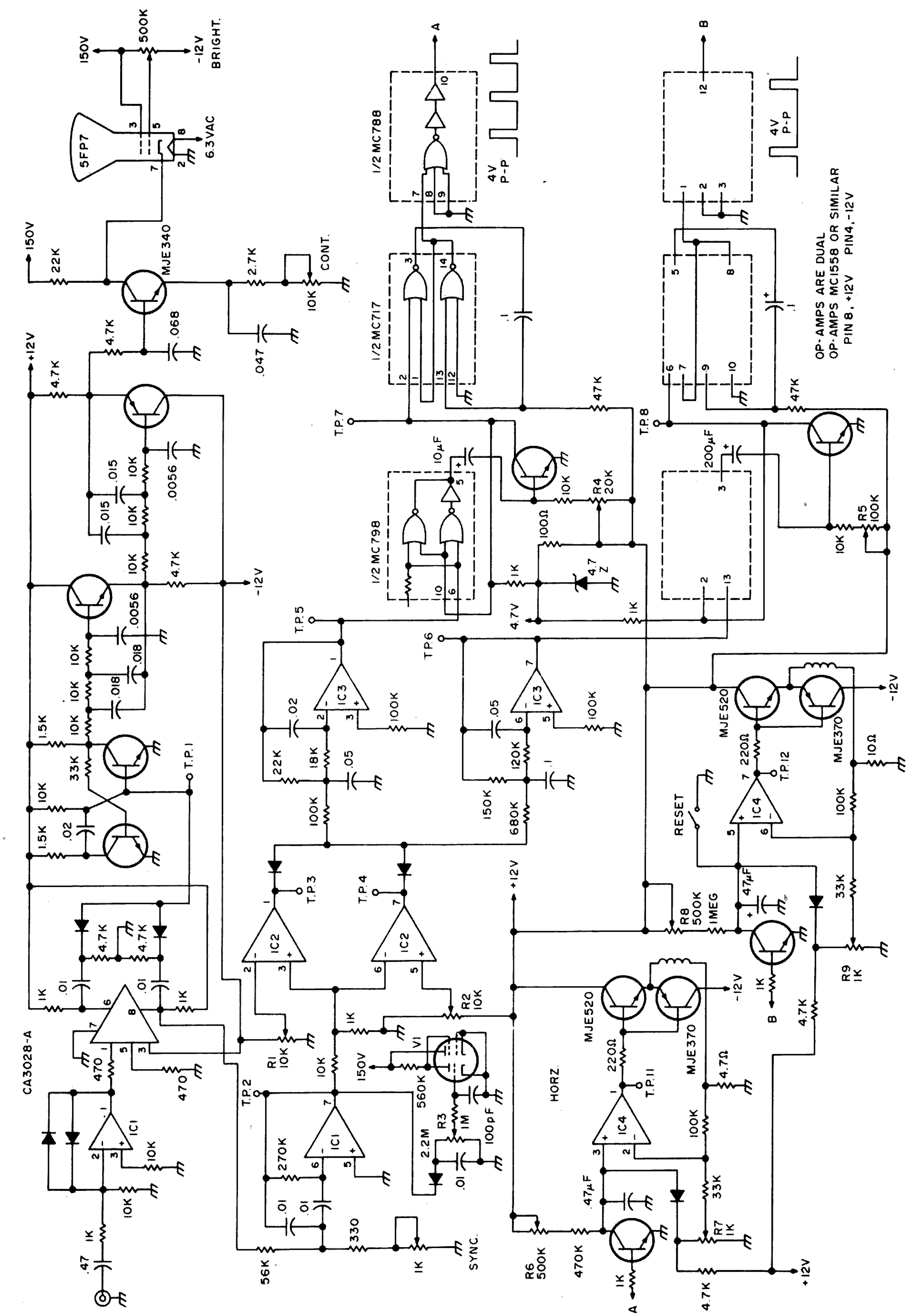

OP-AMPS ARE DUAL
OP-AMPS MC1558 OR SIMILAR
PIN 8, +12V PIN4, -12V
1/2 MC788
1/2 MC717
1/2 MC798
5FP7
6.3VAC
BRIGHT.
CONT.
MJE340
MJE520
MJE370
CA3028-A
RESET
HORZ
SYNC.
4V
P-P

Fig. 1.

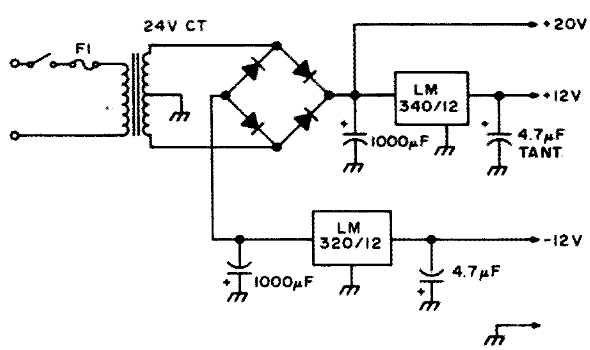


Fig. 2.

knows it makes a very fine looking monitor. I purchased the TR4 cabinet from R.L. Drake and received a blank chassis, blank front panel, wrap around case, rubber feet and all the necessary screws for the case.

Placing To CRT

I chose the left side. I got my nibbling tool out and began taking chunks out of my newly purchased TR4 chassis. I made the necessary mounting brackets for the CRT and located my center line so I could cut a 12.7cm (5") hole in the front panel. Don't you just hate to drill that first hole in a brand new panel?

PC Boards

Next I had to determine where I was going to mount my PC board or boards. I had the rest of the chassis for transformers and PC boards. I decided on using PC plug-in boards. I chose this route because I could break the monitor up into as many parts as I wanted. I could just pull a card out and with an extension cord I made, I could lay the board in front of me on the table and repair or modify it with no difficulty. I broke the monitor into six different parts, so I have six different PC plug-in boards all in a row.

The board lineup:

#1 board has the limiter, differential amplifier, sync tuning, sync threshold, and horizontal and vertical low pass filter;
#2 has the video amplifier;
#3 card has the vertical and horizontal noise immunity circuits;
#4 has horizontal and vertical sweep circuits for the yoke;
#5 is the regulated +12 and -12 V supply;
#6 is the regulated 7.5 kV supply.

I have had no trouble yet with the contacts on the PC plugs and no trouble with the copper getting dirty, thereby causing an intermittent circuit.

Wiring

All the circuits are on the top of the chassis. This leaves the bottom open and free for wiring. The only wiring is between each of the PC plugs, and from all the inputs to the monitor, CRT wiring, and front panel wiring. I would suggest using a color code when doing any wiring. The use of cable ties makes all wiring look good, so keep all wiring running the same direction and up against or flat against the chassis. When a project of any size has any significant amount of wiring, and it is just "hay-wired," it is a good place for "bugs" to get into. A color code and neat wiring helps keep the bugs out.

There are two pieces of Plexiglass on either side of the row of PC cards. This keeps them vertical at all times so they will

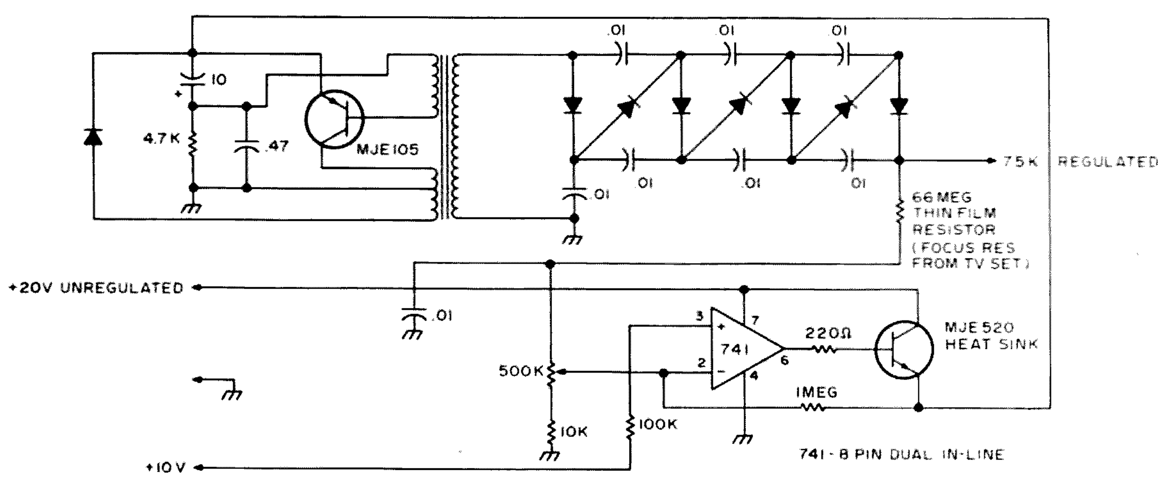
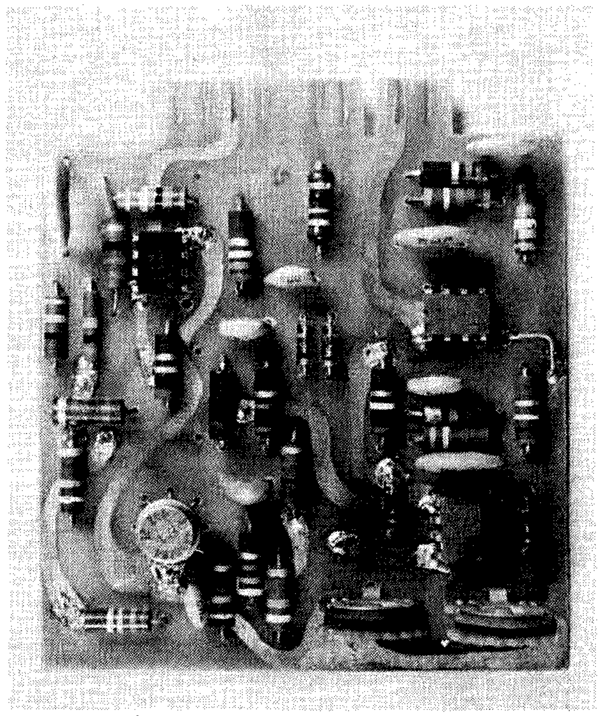


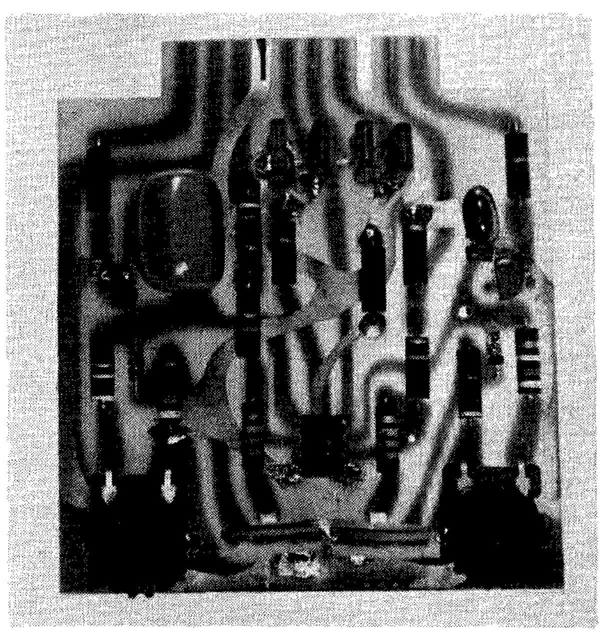
Fig. 3.



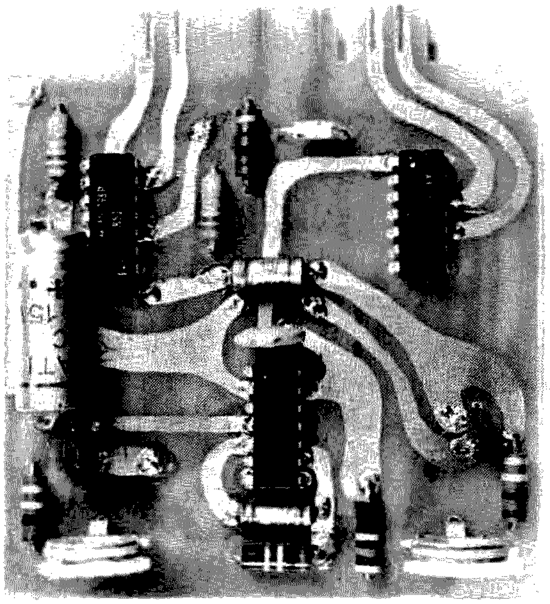
Board #1.

not wobble back and forth, causing damage to both PC boards and plugs. The Plexiglass was cut on a table saw and grooves were also cut so the boards could slip in and out. Then I drilled and tapped the bottom of the holders so I could screw it down onto the chassis.

Well, at this point we have the CRT mounted, all the plugs for the PC boards on the chassis, and the front panel is drilled. Next comes the fabrication of the PC boards.



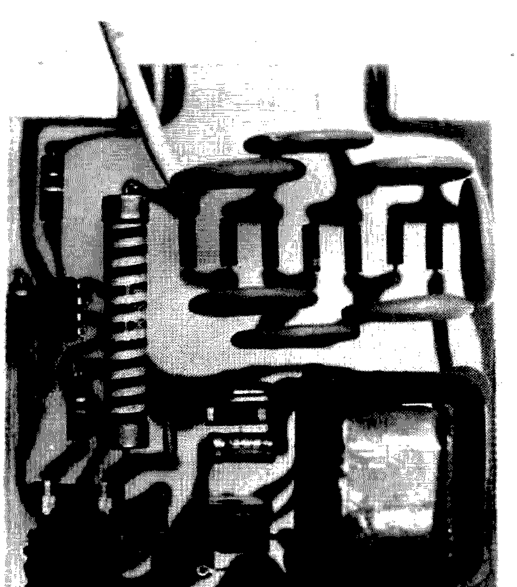
Board #4.



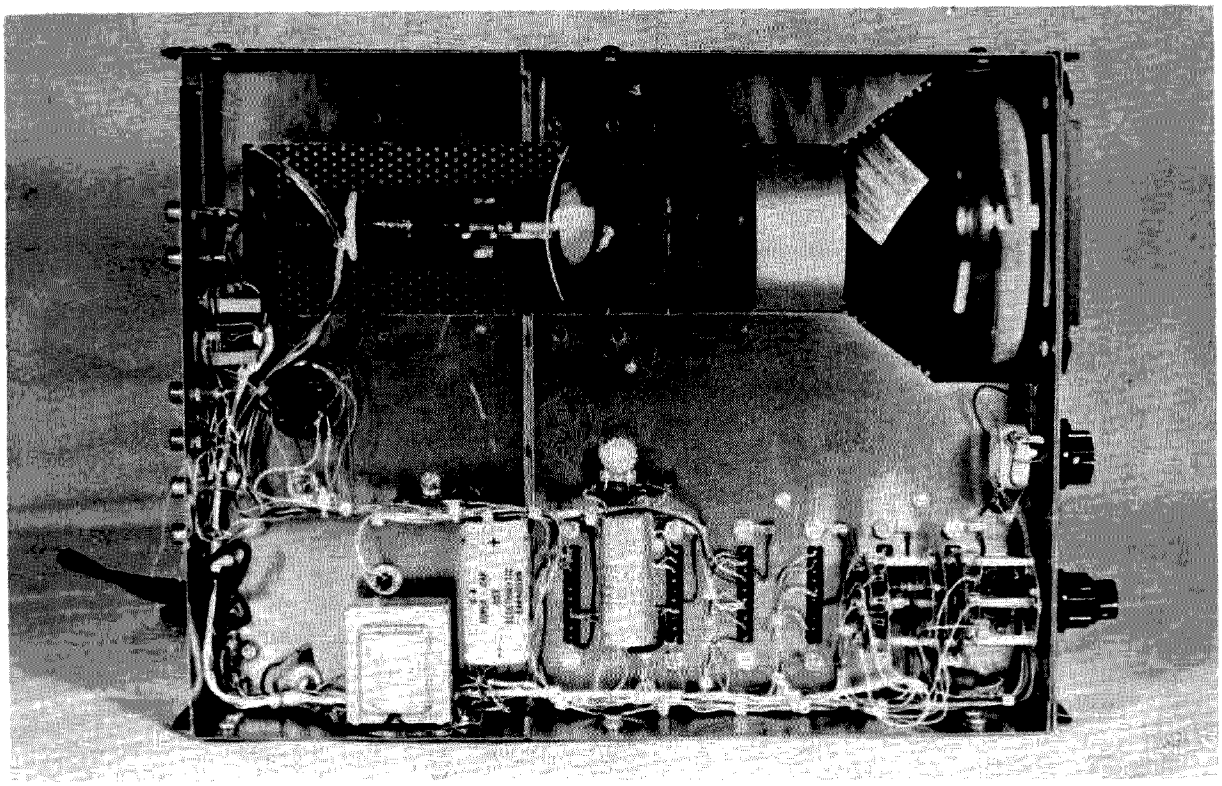
Board #3.

Laying Out The Boards

I'll briefly describe the way I do my boards, since everyone has his own way of doing them. I do my layout four times actual size and use a grid paper that represents 2.54mm (.1") for every square. This lets me see all that room I really have. After the circuit is drawn on the paper I must transfer the drawing to the PC board. I use a pinigraph for this, set for a 4:1 reduction. With a nail or scribe at the end of it I can trace the drawing and at the same



Board #6.



Bottom view.

time scratch in the circuit on the board. (The copper should be clean at this point.) Next I drill all holes to their proper size. I then take a K and E writing pen filled with lacquer paint that has been thinned down, and begin coloring inside the lines. The board is then etched and cleaned. In this monitor it was necessary for me to use 4 double-sided boards and 2 single-sided boards.

The bezel for the CRT front panel is made from Plexiglass. I give most of the credit for that piece to my grandfather. It was cut on a table saw. I first cut the size square I wanted. Next, I lowered the saw blade below the table, then centered the Plexiglass over the blade at the correct distance from the center and edge. With the Plexiglass secure I raised the saw blade up and through the Plexiglass. I did this to all 4 sides, then with a jig saw finished cutting the inside corners out. Using the table saw I was able to get very straight inside and outside edges. The outside corners were cut with a jig saw and rounded smooth with a file. The inside lip of the bezel is just 4 straight pieces cut to fit, then glued in with some liquid glue. The entire bezel was painted flat black.

Touch Ups

The only thing left to do is put on the knobs, lettering, rubber feet, etc., and this I leave to the builder.

As you can see from Fig. 1, it is not an original. It started out as a MXV monitor, but now has MXV, WØLMD, and my own design in it. But like many other serious SSTV builders, when I start on an original circuit, I am bound to deviate from it. Maybe I went too far, but it works very well for me.

Monitor Set Up

(1) Monitor should be set up with a good slow scan signal.

(2) With a VTVM check T.P. 9 for -12V, and T.P. 10 for +12V.

(3) Refer to Fig. 4 for all waveforms.

(4) With scope probe on T.P. 1, waveform A should be present.

(5) The 1K sync control adjusts for the 1200 Hz sync freq. T.P. 2 shows the sync signal B.

(6) Adjust R1 (10K pot) for waveform C.

(7) Adjust R2 (10K pot) for waveform D.

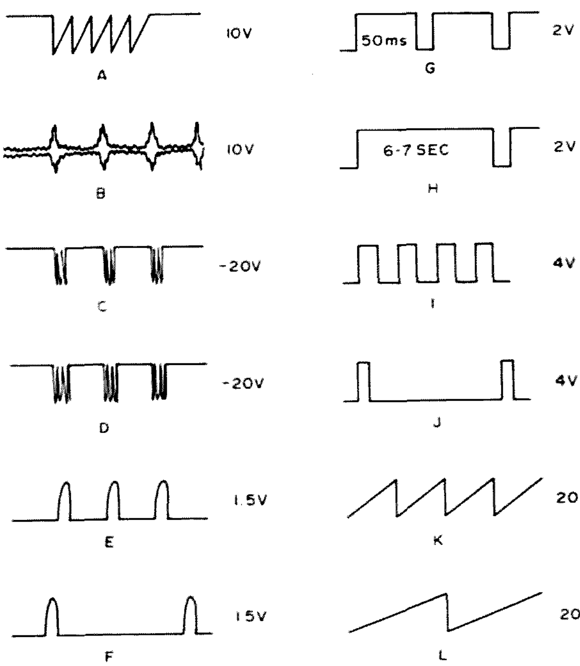


Fig. 4.

(8) T.P. 5 is a low pass filter, and the 15 Hz sync pulse should be present, about 1.5 volts (E).

(9) T.P. 6 is a low pass filter and the 8 second vert pulse should be present about 1.5 volts (F).

(10) Adjust R4 (20K pot) for a +2 volts pulse on T.P. 7, (G), 50 ms.

(11) Adjust R5 (100K pot) for a +2 volt pulse on T.P. 8, (H), 6.5 sec.

(12) Pin 10 on the MC 788 should be the 15 Hz sync pulse about $4 volts, (I).

(13) Pin 12 on the MC 788 should be the 8 sec. vert pulse about +4 volts. (J).

(14) On T.P. 11 there should be a 15 Hz horz ramp, (K).

(15) On T.P. 12 there should be the 8 sec. vert ramp, (L).

(16) R6 in the horz ramp generator-adjust horz size.

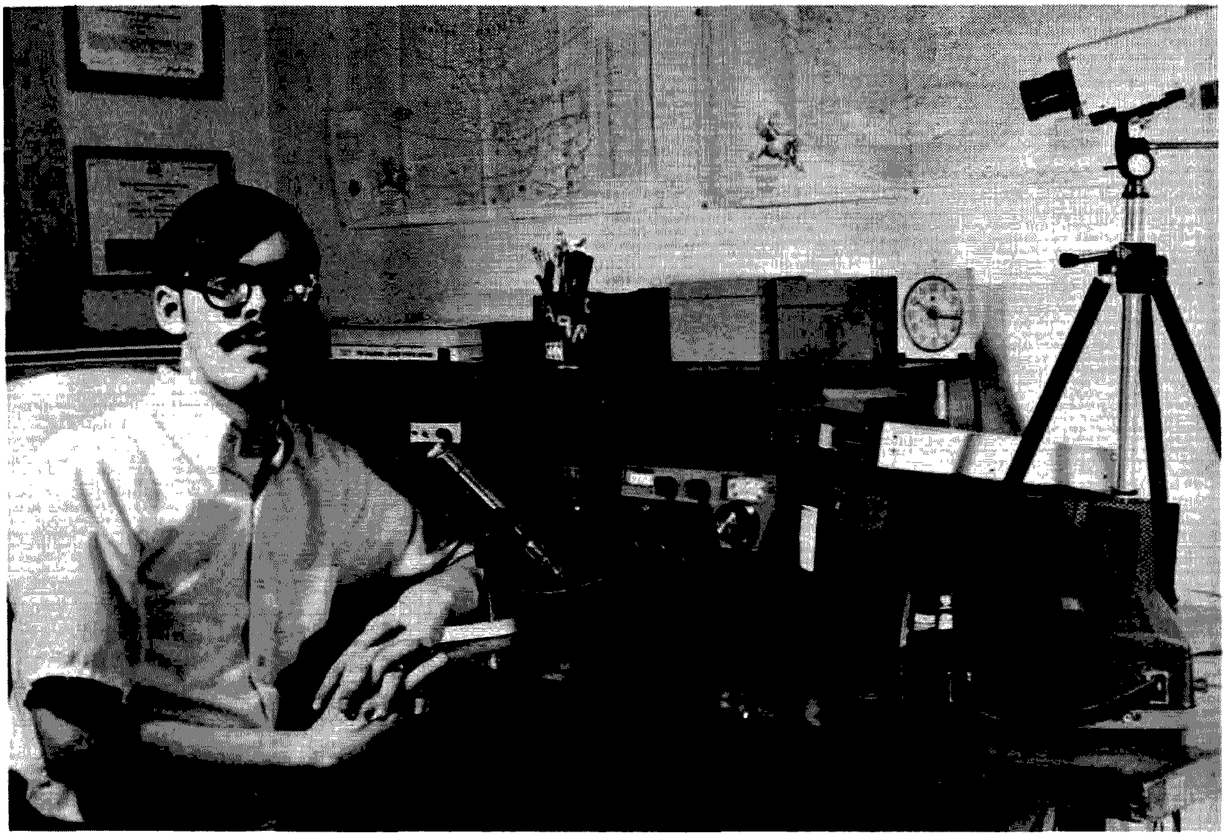
(17) R7 – adjust for horz center.

(18) R8 in the vert ramp generator-adjust for vert size.

(19) R9 – adjust for vert center.

(20) With an accurate 1200 Hz study tone on the audio input to the monitor, adjust R3 for maximum deflection on the 6FG6 indicator tube.

. . . WA9MFF



WA9MFF and his shack. The camera is homebrew, as well as the "EFG" sampler and WØLMD audio analyser.

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El Cheapo Superbeam

This article describes a rotary beam antenna for 10, 15 and 20 meters, with two elements on each band. It works well and is very inexpensive to build.

Design

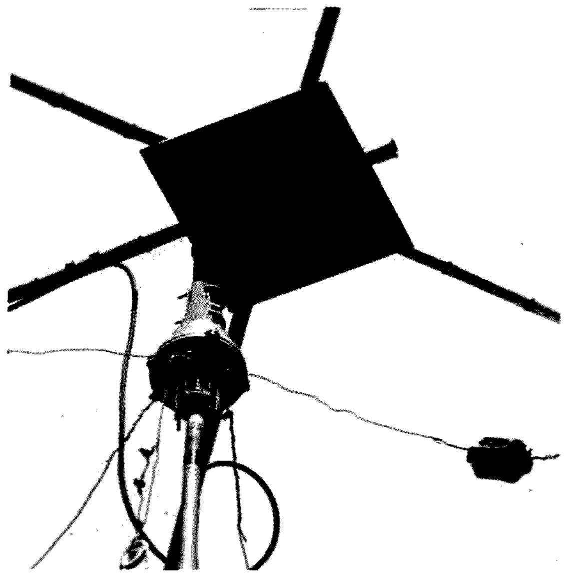
The antenna uses the idea of multiple dipoles connected to one feedline to achieve triband operation. The driven element consists of separate 10, 15 and 20 meter dipoles joined at their centers and fed with one RG-8/U line. Three separate parasitic reflectors are each spaced approximately .22 wavelength behind the driven element. The reflectors are tuned lower in frequency than the driven elements and are about 5% longer physically.

A spacing of .22 wavelength is somewhat greater than the .15 spacing which, according to the charts, yields maximum forward gain. The sacrifice in gain is only on the order of .75 dB, hardly detectable, and is justified by a higher front-to-back ratio and an increase in radiation resistance. The choice of using a reflector as opposed to a director was made to obtain yet another increase in radiation resistance, and for greater bandwidth. To keep cost to a minimum the antenna uses wire elements instead of the more common aluminum tubing found in similar antenna designs, and so it was deemed desirable to keep the radiation resistance high in order to reduce loss due to the ohmic resistance of the thin elements.

Construction

Constructing antennas out of wire elements always poses the problem of how to support them. Ropes and trees and chimneys would severely limit the usefulness of a unidirectional beam such as this tribander. In order to make the antenna rotatable, a framework was built on which the wires could be "hung." The frame is made of bamboo poles and standard hardware – very inexpensive items. If bamboo is not available, plastic water pipe might be tried as a substitute. The photographs and diagrams show how the frame is constructed.

The exact position of the pipe flange under the mounting plate is best determined by holding the water pipe and flange vertical



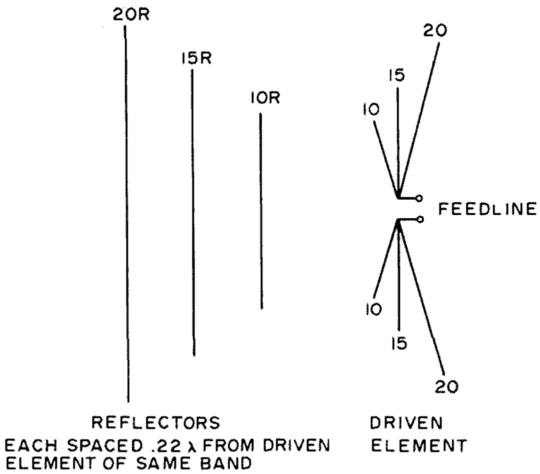


Fig. 1. Antenna theory.

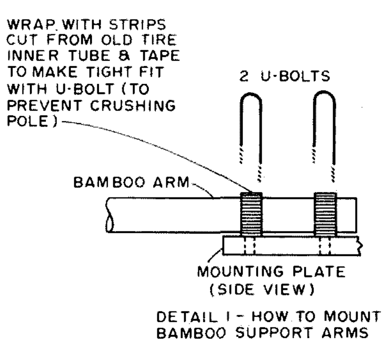
while balancing the assembled frame on top of them, and marking the location. This will not be in the center of the plate since the fifth support arm unbalances the weight distribution. Mounting the flange at the point of balance will reduce the strain on the rotator bearings.

The wire elements can be fastened to the support arms by means of tape or fish line or whatever you have handy. The excess length of the wire is allowed to hang down from the supports. Allowing the ends of the elements to droop does not seem to hamper operation of the antenna. After all, this beam is really just the top half of a quad.

Although no tests were run to compare performance with and without the 1:1 balun in the feedline, there is no reason why the antenna should not work without it. The beam shown in the photographs uses a Hy-Gain BN-86. Less expensive baluns such as the kit from Amidon Associates or the Greene Insulator might be tried. Even if the balun is eliminated, it is wise to include the fifth support arm to carry the weight of the coax feedline and prevent sagging of the driven element supports. The feedline is taped to this arm, and the center insulator in the driven element is also supported from this pole by a short piece of wire or fish line.

Installation and Tuning

The performance of this antenna will be determined by the height at which it is mounted. Towers are expensive; however, telescoping type TV masts are reasonably priced, with 50 footers going for around $35. If you must ground mount the mast, a 50 footer should allow you to get the antenna up to around 37 feet. This allows for some overlap of sections and assumes you will not extend the thin top section more than a couple of inches. Mounting the rotator between the mast and beam will give you another foot or so, and if you can set the whole thing up on a rooftop, so much the better. A very successful – slow but safe – method of raising the antenna is to temporarily fasten the guy wires, leaving some slack, and then extend the mast until the wires are taut. Loosen the guys, again let out a little slack, refasten them, and raise the mast a couple more feet. Repeating this operation several times takes longer, but is much safer, than getting three or four men



BAND	SPACING	START WITH DRIVEN	START WITH REFL
10M	7'7"	16'10"	17'9"
15M	10'3"	22'6"	23'9"
20M	15'7"	33'10"	35'6"

DIMENSIONS CHART

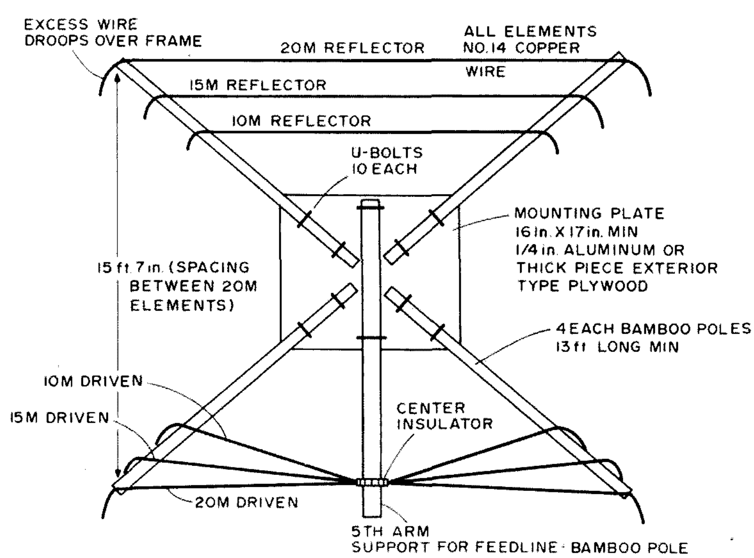
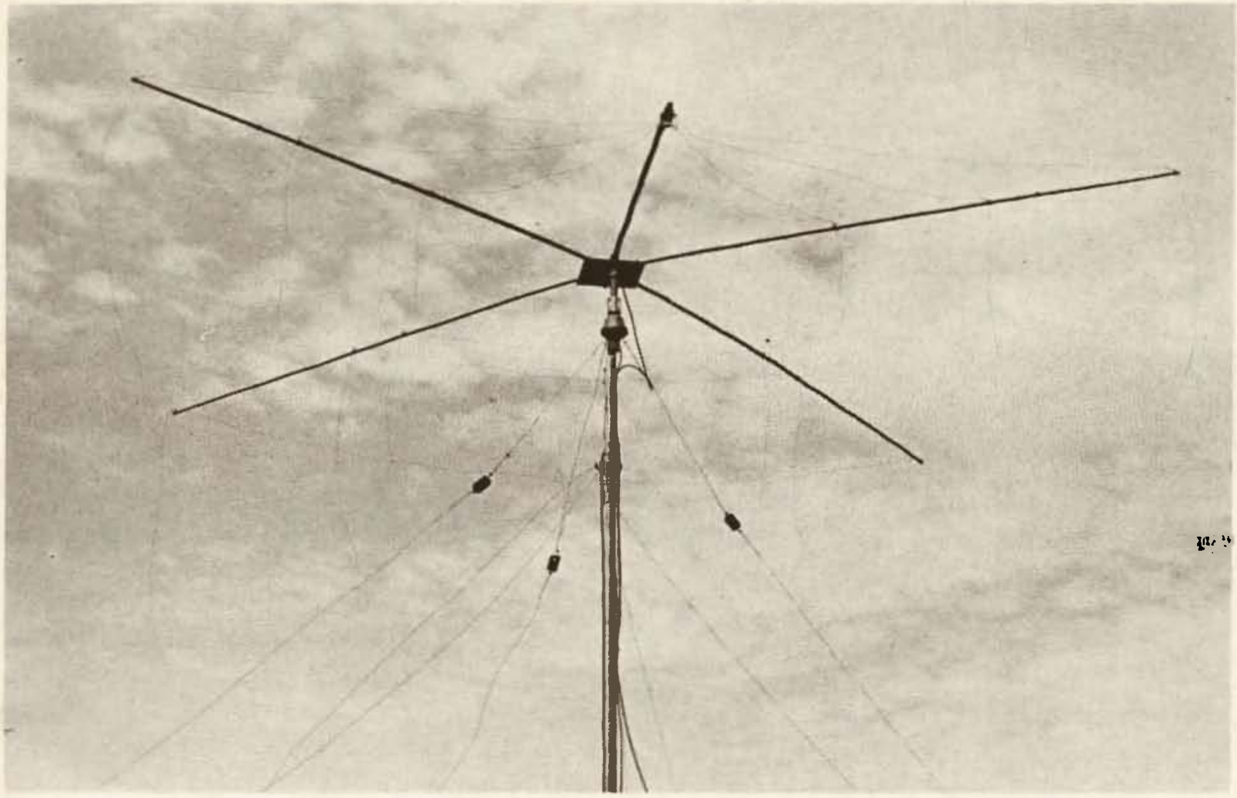


Fig. 2. Frame – top view – this frame mounts parallel with the ground.



to hold the ends of the guys and juggle their tensions and positions, trying to keep the antenna, rotator, and mast from all crashing to the earth. The heartbeat increases rapidly as a slight bow in the mast becomes a full-fledged bend just as the crunching of bamboo fills the air. Ask one who has been there!

Before you raise the antenna out of reach, it should be tuned. (It might also be wise to attach a rope and pulley somewhere near the top of the mast for use as the apex of a 40/80 meter inverted V, thus completing a 5 band antenna system.) Tuning this antenna is rather easy, as there is nothing to tighten or loosen, or slide in or out. Merely snip at the drooping ends of the elements with wire cutters. Trim as you watch your grid dip meter, or swr bridge, or noise bridge. Adjust the reflector and driven elements together, one band at a time, remembering that the reflector should be maintained about 5% longer than the driven element. The dimensions given are starting points only and are purposely long to allow for tuning. It would be best to start with 20 meters and work your way up in case there is any interaction between bands. Keep in mind that the resonant frequency of the antenna will go up when it is at its full height, and also that a 2 element beam with a reflector will drop off in performance faster as you move down in frequency than as you swing upward. So tune for a lower

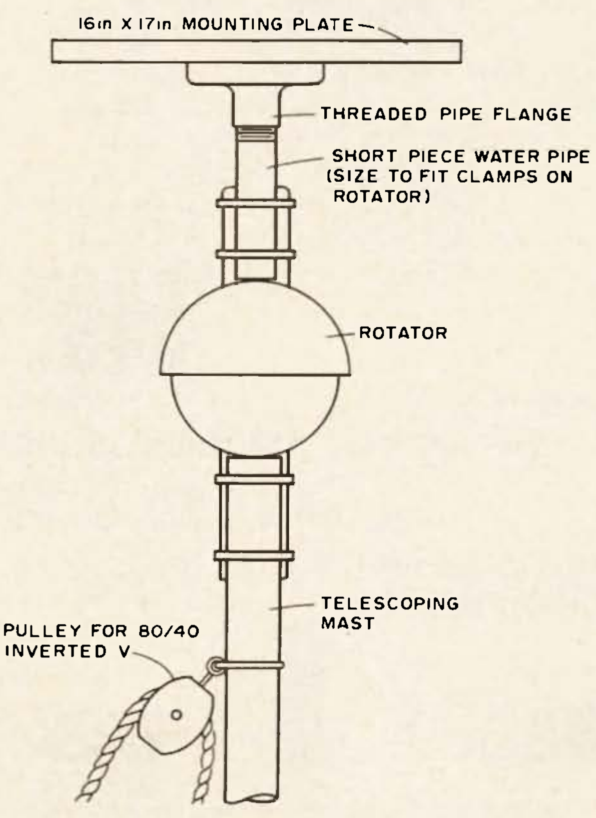


Fig. 3. Antenna-to-mast mounting.

frequency in the band, and if you err on the length of the reflectors, it is better to be on the long side. At 35 feet this antenna has given a good match to RG-8 coax with no extra matching devices. This is due, at least in part, to its higher than usual radiation resistance as compared with the close spacing of some commercial 2 element tribanders.

Performance

If you have tuned the elements correctly, the antenna will exhibit a definite front-to-back ratio. You can check this by listening to a signal on the station receiver while rotating the beam. On some signals the effect will be more dramatic than on others, due to the angle at which the signal is arriving and the fact that some DX signals may be coming through over both long and short paths simultaneously. In general, though, there should be a difference of two or three S units when making this test. The front-to-side discrimination will be even greater.

With this antenna at a height of only 35 feet it has been possible to hear and work plenty of DX, although no one should expect to be able to crunch the Big Guns using large arrays up at 80 feet. Running 100 W input I worked about 80 countries in 9 months time. Adding a pair of 813s and 5 months brought the total up to over 130 worked. This was during 1970 and early '71. I am a college student, so my operating hours are somewhat limited, and I did not spend all day every day tuning for DX. I do feel this project can provide the ham operating on a limited budget (pun) with an effective rotary beam antenna and a chance to work some new ones.

In closing I wish to thank my non-ham dad, Mr. Abraham Smolar, for his helpful suggestions and great patience.

. . . WA6NLQ

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The Smart Alarm

One evening I returned to where I had parked my car, only to find it gone. Since then I have installed a burglar alarm in the two cars that I have subsequently owned.

This article reviews the basics of installing an alarm system in a car and describes a new, all solid-state circuit that replaces the key operated switch in an ordinary alarm system.

Basics

All alarm systems are basically made of three sections — the sensors, the control circuit and the alarm. The control circuit must be able to take the signal from the sensors and turn on the alarm. The alarm must remain on in spite of the fact that the signal from the sensor is only momentary. In Fig. 1, the simplest alarm circuit is shown. The relay is wired so that it is self latching, thus a momentary closure of the sensor circuit will cause the bell to ring continuously until the keyswitch is turned off.

I had installed this type of alarm system in a previous car, and after more than a year of use I was keenly aware of its drawbacks. On several occasions I returned to my car and opened the door without first turning off the alarm. This was very embarassing, especially late at night after returning from a movie. Also, it was difficult to first go to the driver's side to turn off the keyswitch and

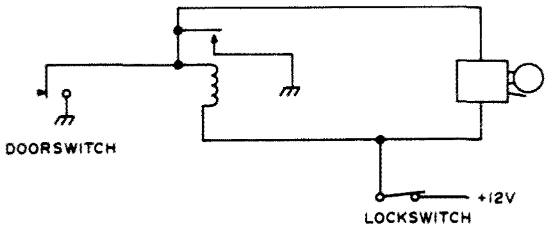

Fig. 1. Typical alarm circuit.

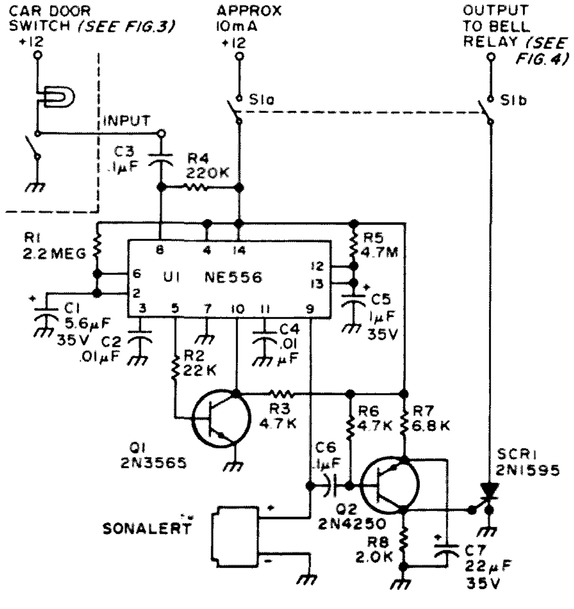

Fig. 2. Solid state burglar alarm.

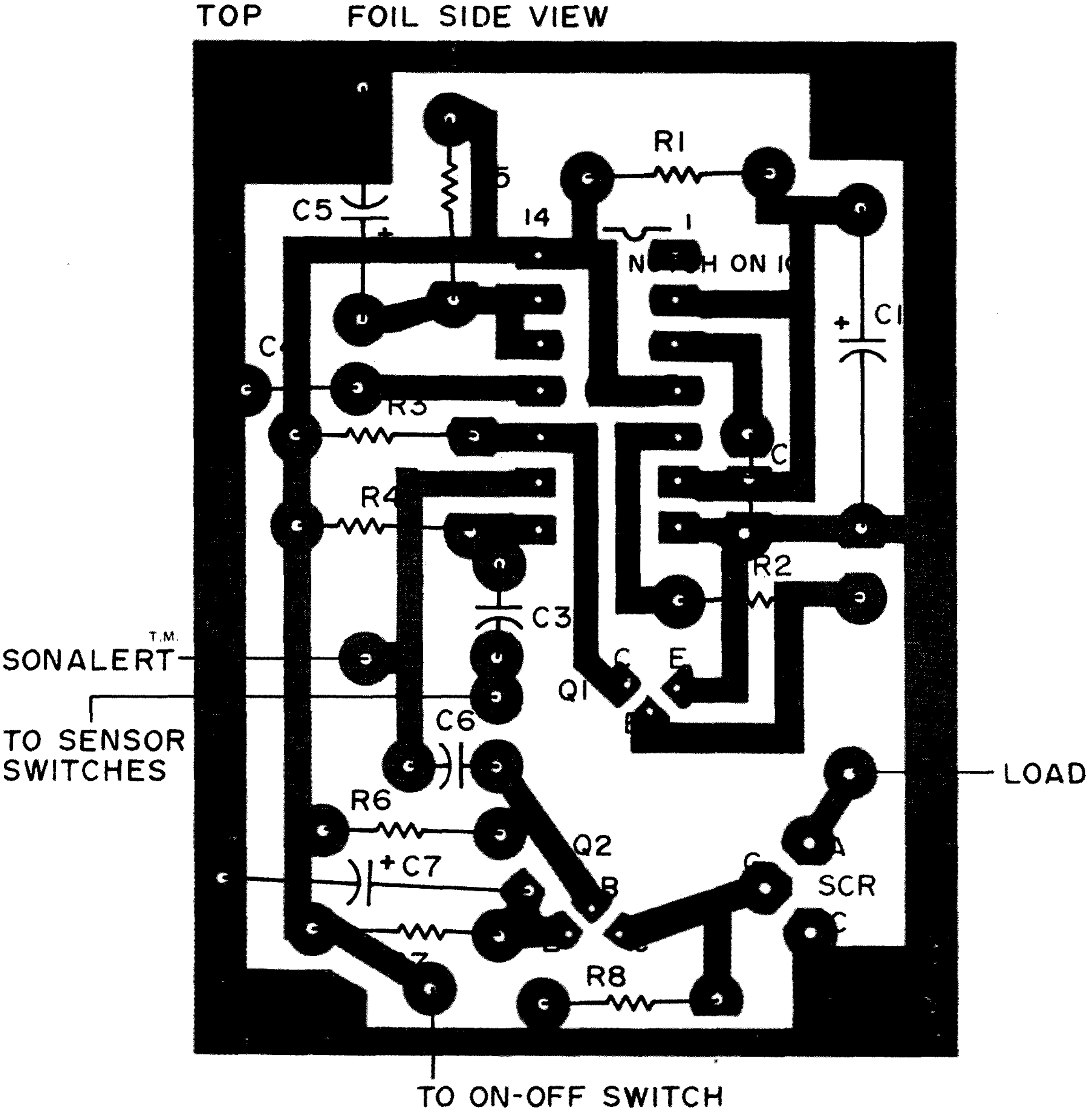

Fig. 3. PC layout (200%).

then go back to the passenger's side to let someone in the car. In addition, the lock-switch is difficult to hide. At least one ham in the Los Angeles area found that a burglar outsmarted the alarm system in his car by breaking the window and removing the mobile rig without opening the car door.

Another suggestion that is not obvious is that the alarm system is worthless if the battery and battery cables are accessible. This means that you are protected if you have a Volkswagen because the battery is inside the car, but if the battery in your car is under the hood you are vulnerable. It is advisable to invest in a set of hood locks for your car. In addition, burglars have been known to crawl under a car with an alarm system and reach up next to the engine block and cut the battery ground wire. This means that your alarm cannot be secure unless you run an extra - and + wire in such a way that it is inaccessible from the bottom of the car. Ordinary small gauge wire (preferably with teflon or high temperature insulation) can be used as the maximum current it will need to carry is about 4A. Unless the main battery leads are cut, they will not be carrying any current.

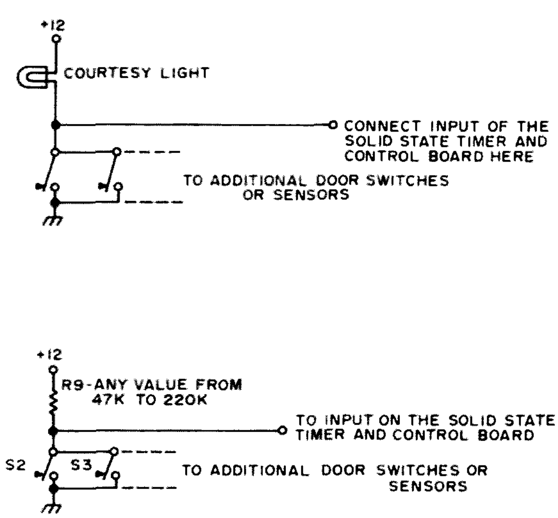

Fig. 4. (a) Alarm system using the existing switches in a car with grounding type courtesy light door switches. (b) If you install separate switches or sensors, use this circuit (see text).

A previous article in 73 Magazine (Mobile Burglar Alarm, May, 1973, 73 Magazine) gave me the idea of using timers to allow a person to turn on the alarm system by throwing a switch inside of the car, and after a certain timed interval the alarm would be armed. When the owner returns and opens his car, he has a few seconds delay to be able to shut off the alarm system before it can ring. However, there is no reason why the control system cannot be built with solid-state circuitry rather than using thermal time delay relays.

Circuit Description

This circuit is inexpensive, easy to build and reliable. It uses a dual timer integrated circuit that is available from Signetics, National and Raytheon. If you use good electrolytics, the circuit will be very stable over a wide temperature range.

The first half of the IC is designed to begin a timed interval beginning with the first application of the 12V supply. R1, C1 provide the time constant and with the values given in the schematic the timed interval is about 14 seconds. The output of timer 1 is HIGH during the timed interval and LOW after timeout. This is inverted by Q1. Pin 10 is the reset input of timer 2. When timer 1 is timing, the output of Q2 is forcing pin 10 LOW thus timer 2 is ignoring any trigger inputs. After timer 1 has completed its period, timer 2 is able to function the first time that its trigger input drops from HIGH to LOW. The trigger input, pin 8, is biased high by R4 and when the door switch or sensor makes contact, C3 makes the necessary falling edge to trigger timer 2. Note that in Fig. 3 the courtesy light provides the +12V to discharge C3. Some cars, such as Volkswagens and Ford Pintos, do not use a grounding type switch, but instead use a complicated switch that is completely above ground potential. So in this case it is necessary to install independent grounding type switches for the alarm sensors. It is necessary in this case to put a resistor, R9, from this trigger line to the +12V supply in order to keep C3 discharged.

Timer 2 has a time constant of about 6.1 seconds when using the values specified for R5, C5. This is about the minimum time that one can comfortably enter the car and shut off the enable switch, even when carrying a bag of groceries.

The output of timer 2 is high during its timing period but we are only interested in

the falling edge, indicating the end of the timed interval. Transistor Q2 translates this falling edge to a positive going pulse. This turns on the gate of SCR1 which is self-latching. The SCR grounds one end of the relay coil, Fig. 4, and the relay pulls in causing the bell to ring. The SCR cannot turn off until the enable/disable switch is turned off, removing current flow through the SCRA. R7 and C7 are necessary to keep transients from turning on the SCR when the enable switch is first turned on.

In addition, I am absent minded and forget that I have the alarm system on so a Mallory Sonalert makes a loud tone during the 6 second period beginning when the car door is opened.

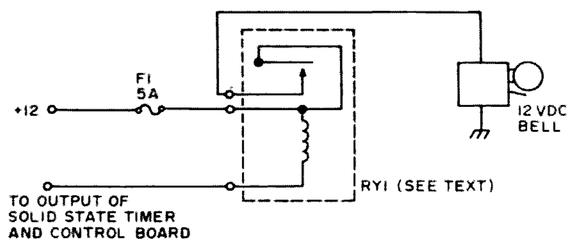

Fig. 5. This circuit is not latching because the SCR on the solid state timer and control board does the latching.

If a burglar enters the car, he will hear this tone and perhaps be wise enough to leave quickly. If he does not, at the end of 6 seconds this tone will stop and simultaneously the bell will begin to ring – hopefully scaring him away. This added feature of having a reminder tone that the alarm is still activated is very convenient.

Construction and Operation

A layout is provided for a printed circuit board. The parts that I used may not be available in your junkbox. If not, this is simple enough to breadboard on perf board. The transistors are very inexpensive plastic types. Note that Q2 is a PNP and is wired as a grounded collector configuration. The switch S1 is a DPDT subminiature toggle switch that is carefully hidden in my car, but you can use anything that has at least DPST contacts. It is, of course, necessary to hide this switch in a place that is well hidden but accessible. Avoid obvious places.

The relay and bell that I am using are one unit but if you get a bell without a relay inside of it, any 12V relay with SPST contacts rated at 5A will do. A horn relay is wired internally with one contact connected to one end of the coil as shown in Fig. 4. The relay is necessary because the SCR must see a constant load to remain in the ON state.

This circuit is not meant to be used while the engine is running. Most ignition systems have huge voltage spikes when the engine is running. These could damage the IC so it is better to not turn on the enable switch while the engine is running. As a burglar alarm is not usually used when the engine is running, it would be unnecessary to add the filter and zener to protect the circuit.

This circuit may also be used in a home alarm system. It may be operated from a simple filtered 12V supply. It is not necessary that the supply be regulated. It would be even better if the alarm system were powered with batteries with an ac supply in parallel. Then the system would not be off in the event the ac were shut off, and the batteries would not discharge as long as the ac is on. The output relay may drive anything – a transmitter, lights, horns, bells or an automatic telephone dialer. The sensors may be anything that provides a contact closure, such as a normally open momentary contact. Don't forget to use R9 as shown in Fig. 3. If your sensor is not normally open, simply use a small relay to convert it.

This circuit cannot guarantee that your mobile rig is safe, but it will help. It is inexpensive and easy to build, and its advantages over the ordinary alarm system make it well worth the effort.

Parts List

The following suggested parts are the ones used for the layout shown. Other parts may be used, but they may not fit the PC layout. Tantalum capacitors are recommended as they are generally more reliable and stable, especially over the wide temperature range to which a car is often subjected.

C1 – 5.6 µF 35V (Sprague 150D565X9035B2)
C2 – .01 µF ceramic (CK06BX103K)
C3 – .1 µF ceramic (CK06BX104K)
C4 – .01 µF ceramic
C5 – 1.0 µF 35V (Sprague 150D105x9035A2)
C6 – .1 µF ceramic
C7 – 22 µF 15V (Sprague 150D226X0015B2)
F1 – 5A fuse in an in-line fuseholder
Q1 – 2N3565
Q2 – 2N4250
U1 – 556 Dual timer

R1 – 2.2M 1/4W (RC07 style carbon resistor)
R2 – 22K 1/4W (RC07 style carbon resistor)
R3 – 4.7K 1/4W (RC07 style carbon resistor)
R4 – 220K 1/4W (RC07 style carbon resistor)
R5 – 4.7M 1/4W (RC07 style carbon resistor)
R6 – 4.7K 1/4W (RC07 style carbon resistor)
R7 – 6.8K 1/4W (RC07 style carbon resistor)
R8 – 2.0K 1/4W (RC07 style carbon resistor)
R9 – any value between 47K and 220K (not located on the circuit board)
RY – 12 volt SPST relay, see text
S1 – DPST or DPDT subminiature switch (Alco MST 205N)
S2 S3 – grounding type car door switches, see text
SCR1 – 2N1595
Sonalert or equiv. (SC628)
Bell – a LOUD 12 V bell or you can use your horn or a transmitter.

(Author's Note: I have noticed that there is a substantial variation from device to device in gate sensitivity of the 2N1595 SCR. If you happen to get an SCR with a low gate sensitivity, it may be necessary to lower the value of R7. In that case, it will be advisable to change C7 to 100 uF 15 V, to remove transients that can trigger the SCR and bell when the car door is closed.)

. . . WA6KBL

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An Intimate Look at 160 Meters

Since its return after WWII, the 160 meter band has been largely ignored by the majority of amateurs, many having never operated there at all during their entire amateur experience. With the decline in usability of the "big three," 20, 15 and 10 meters, due to the decline in sunspots, and the consequent pressure on the remaining hf bands to absorb this influx of "displaced persons," the interest in our 6th hf band is growing at a great rate, as the numbers of new or recently reactivated stations testify. Since the band is unique in its characteristics, the purpose of this article is to try to explain what to expect from 160, and offer some suggestions which may help the newcomer get started on this interesting and challenging band.

Recent changes in the FCC regulations have increased the available frequencies and raised the maximum power limits in most areas of the U.S., although still requiring substantial decrease in power at sundown to prevent the possible interference with the Loran "A" service which shares the 1.8- 2 MHz band and has priority. The 160 meter band was taken over at the start of WWII and the Loran service established there. Like many things, once established, it became difficult to dislodge, and only now with the increased use of the Loran "C" service at 100 kHz and the reduction in the use of Loran in general as a prime navigation system, have the restrictions been eased for the ham operators.

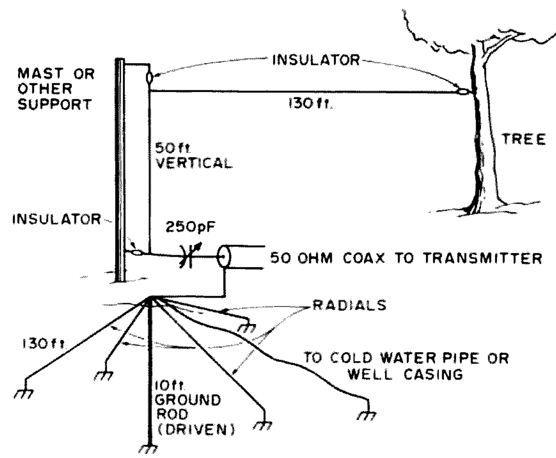
For purposes of frequency assignment, the band has been divided into eight sub-bands, designated "a" thru "h", "a" being 1.800–1.825, "b" 1.825–1.850, etc. Unlike other bands, there is no exclusive CW segment in each sub-band and everyone has the right to operate anywhere within the band. A gentleman's agreement has grown up, with phone above the first 10 kHz of each sub-band and CW below. There is *no* authorized operation of RTTY, FM or Slow Scan; only A1 and A3 operation is permitted.

Probably the first problem that you will face in getting active on this band is finding equipment that will cover 160. Many so-called all band rigs are 80 thru 10, leaving out 1.8 – 2 MHz. There are still many of the older AM era rigs around such as the Elmac AF 67, the Ranger series, the perennial Arc 5 equipment and others, often reasonable in price. They will do an excellent job on CW and of course can be used on AM as well. The Central Electronics 20-A has 160 sideband and CW provisions. Newer equipment with 160 capabilities include the Yaesu FT-101, the Drake Twins, the KW line and

others. Heathkit had a 2 channel crystal-controlled rig on the market, but recently dropped it from their line. There are many home-brew rigs in use, and, as another approach to the problem, there are a number of HW-12 rigs that have been modified to cover 160 and sound great. (*73 Magazine*, January 1969, p. 12, "HW 12 on 160.") The transverter in the 1969 ARRL handbook (*Radio Amateur's Handbook*, 1969 edition, p. 285, "Transverter for 160") is a unique and very satisfactory method of getting on the band by making use of a SSB rig that does not cover the band. The frequencies involved are low enough to make inexpensive solid state equipment with fairly high power a possibility, as many of the low-priced, high-power transistors will perform well at 2 MHz.

After one has bought, built or modified a rig that will be suitable, the next hurdle is the antenna. Those of us who need a tractor and gang mowers to do the lawn don't really have a problem, but the apartment dweller and the suburbanite are almost certain to have problems trying to fit a full sized 260 foot dipole in the back yard or on the roof. However, many potent signals come from less than full sized antennas and for casual work, tying the feeders of the 75 meter dipole together and feeding the whole thing through a tuner is a popular approach. If serious DX work is attempted, some form of loaded vertical is usually used, and with the best possible ground system, even if it is only a connection to a cold water pipe. The better the ground, the better the results. On this band the "underground antenna" is almost a reality. More effort can be profitably spent in planting radial wire, as much as possible, in the ground, rather than hanging it in the air, and the results will be almost a reflection of the effort expended along these lines. (*QST*, July 1971, p. 16, "Recommended Reading for Ground Plane Antenna Installation.")

After considerable experimenting with various antennas, including a full sized inverted vee, loaded verticals, etc., the antenna diagrammed in the accompanying sketch has worked well both locally and for DX. It consists of a total of 180 feet of wire and therefore it occupies no more space than a conventional 80 meter dipole. As an added bonus, it may be used as a 3/4 wave antenna on the 80-75 meter band with excellent swr characteristics across the whole band, simply by shorting out the series tuning capacitor. The vertical and horizontal components seem to give both high and low angle radiation, and it seems to be completely omni-directional, with no noticeable lobes appearing. (*Radio Handbook*, Orr, 18th edition, p. 485.) (*Wire Antenna Handbook*, Orr, p. 103.)



3/8 Wave 160 meter antenna. 3/4 Wave 75-80 meter antenna. Ground should be at base of antenna. Drive a 10-foot ground with at least 2 130-ft radials and 2 60-ft radials. Also run a wire from this point to the nearest coldwater pipe or well casing. Run radials in a straight line if possible, but DO NOT SHORTEN. If space considerations do not allow full length, zig-zag or spiral to fit. Bury a scant inch in ground to protect wire.

75-80 meter adjustments: Short circuit tuning condenser and trim antenna for lowest swr at desired portion of band, or at midband if both CW and Phone operation is desired. Short should remain in place for 75-80 operation.

160: Remove short and adjust capacitor for lowest swr.

The techniques for working DX on 160 are a bit different, and a brief explanation may help you to understand what to look for and what to expect on this band. Many times, DX openings, or the possibilities for openings, may be anticipated by making use of various commercial and other stations in

different parts of the world and of the USA. These signals, when heard with good strength, are a good indication that a DX opening may exist. For example, DHJ, a commercial station in Europe, operates on 1830 kHz. If you hear it peaking S-9 you can be almost certain that an opening to Europe is probable. Other stations may help pinpoint openings to areas of the U.S. These include:

WWV	Denver, Colo	2.5 MHz
WWVH	Hawaii	2.5 MHz
KPH	San Francisco, Calif	2054 kHz
WNU	Gulf Coast	2048 kHz
WCC	East Coast	2036 kHz

There is also a low-power ship-to-shore AM station in Ireland, EJK, Valencia Radio, on 1827 kHz. If you hear him, the band is really open. In addition there are a number of commercial AM stations operating in the 1.6 MHz area that might be used as beacons to a desired area within the USA, and W1AW, with its scheduled code practice and bulletin transmission on 1805 kHz nightly is also a good band condition indicator.

The "DX Window" is a 5 kHz wide segment, 1825 – 1830, and is the agreed-on international calling frequency. The whole thing is a gentleman's agreement, DX calls CQ in the window and listens 1800 to 1808 for replies. We do the reverse. If we all cooperate and keep the window open for weak DX stations to use, we all benefit. If a strong U.S. or other station exercises his *right* to use the frequency, the system fails, and the weak DX signals go unheard and unworked. Even in the northeast, with the least assigned bandwidth, the small portion set aside voluntarily for this purpose seems like an excellent investment with a high potential return for all of us.

The summer months can produce long periods where the S-9 plus static level makes the band useless for all but strong local contacts. However, a cool front may move in and bring with it good to excellent conditions, equal perhaps to an average winter evening with low noise levels. Remember, when our conditions are at their worst due to thundershower activity, the southern hemisphere is experiencing their best. DX signals are almost always between areas of darkness, with peak periods at dawn and, to some lesser extent, dusk. A calculation of local sunrise or sunset and the DX areas suntime should indicate optimum listening times to a given area of the world.

Although working DX on this band is not easy, that seems to make the band more interesting and challenging. An afternoon of casual operating can result in a WAC on the higher frequency bands, but on this band the certificate represents far more effort, skill and, let's face it, luck. At present there are over 50 holders of WAC on 160, according to Stew Perry's latest 160 DX Bulletin. Incidently, Stew Perry W1BB, "Mr. 160", has WAC #1 and over 120 countries confirmed at last count.

Both ARRL and CQ sponsor special contests for 160, and the turnout is excellent, the competition is fierce, and everyone has a ball. CQ has a world wide DX contest in January and ARRL has a Sweepstakes-like affair in December. Both are CW only contests, but possibly one or both may be expanded to include phone. With increased use of SSB, and higher power authorized, it might be quite a bash. Of course, the regular DX contests, field day, and the sweepstakes all include top band activity, and some DX expeditions in fact are primarily for operation on this band.

There are a number of nets that use 160, among them the "Greyhaired Net" which is an AM only group, and the "Top Band SSB Net" which meets at 2100 EDST on Wednesdays at 1812 kHz, and which has over 225 members at last count, which for a net that is about 2 years old is quite remarkable.

Daytime activity is practically nil, although 50 to 100 mile contacts seem routine with average installations. Consider for a moment the possibility of using NBFM, or mobile operation as an adjunct to the service nets such as ECABS and MIDCARS. Who knows, possibly a whole new use for the band might be developed, as with the repeater service on 2 meters. As I said at the beginning, the band is lightly occupied, and has more frequencies available than in the past, and room still exists for experiments and new ideas.

See you on the low end of "Top Band!"

. . . W2NYU/WA1JJV

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c/o 73 Magazine
Peterborough NH 03458

RF POWER AT 432

This is a down-to-earth description of the kind of nitty-gritty details involved in getting a portable solid state UHF amateur station on the air. The overall design is flexible, leaving room for improvement, modification, or adaptation to specific needs.

It may not be the best station of its kind in the world – which would cost you N times as much – but it does work, is low cost, is lots of fun, and you can't buy one like it off the shelf!

RF Power

Don't go getting ideas now. When I say power with low-cost solid state UHF I mean lots of milliwatts. Right now the rf output is lighting a No. 48 bulb to more than 2V brilliancy, and that has to be at least 120 mW because the 48 is a 60 mil 2V job. On the amateur's milliwattmeter it measures a good 150 mW.

And don't think that's so easy, either. When you hook up the exciter, the first rf amplifier with its dc bias – and the second one which may or may not have dc bias because it is supposed to be driven by the first – don't be disappointed if the bulb doesn't light up right away. Mine didn't. All sorts of things can happen. Remember, you're back in the old triode days once again now, with plenty of unwanted feedback available through those pesky little scraps of silicon. The inputs and outputs of each one of them (and note that we're up to a total of six already) beginning with the 54 MHz rock stage, must be reasonably matched and reasonably loaded to avoid the necessity of neutralization. And they must be reasonably in tune also. When you do arrive at this happy condition, the rf bulb – or other good UHF indicator-load if you're lucky enough to have one – will show milliwatts to the tune of over a hundred.

The first stage takes the 1–3 mW out of the exciter and brings it up to 15 or 20, and the second stage brings that up to about 150 mW. At least there's an approximately consistent gain of at least 10 dB per stage showing. Anyone for a solid-state 1½W at 432? Maybe so, but start with a stuffed pocketbook.

With the 20 dB beam the 150 mW will sound like 15W from a dipole in the direction you point it.

Now the details of getting that 150 mW. Fig. 1 shows one way to do it. I chickened out on the two connectors and a cable between the first and second rf stages, but don't let that bother you. Those phono plugs are only 4¢ each, so who cares. I had the power up to about 150 mW with them in, and probably would get the 150 now anyway, with the additional peaking since then. It's the same old story, you fight and fight and gradually, after hours and maybe days, things begin to match up . . . your output climbs, and finally you throw the switch and that old

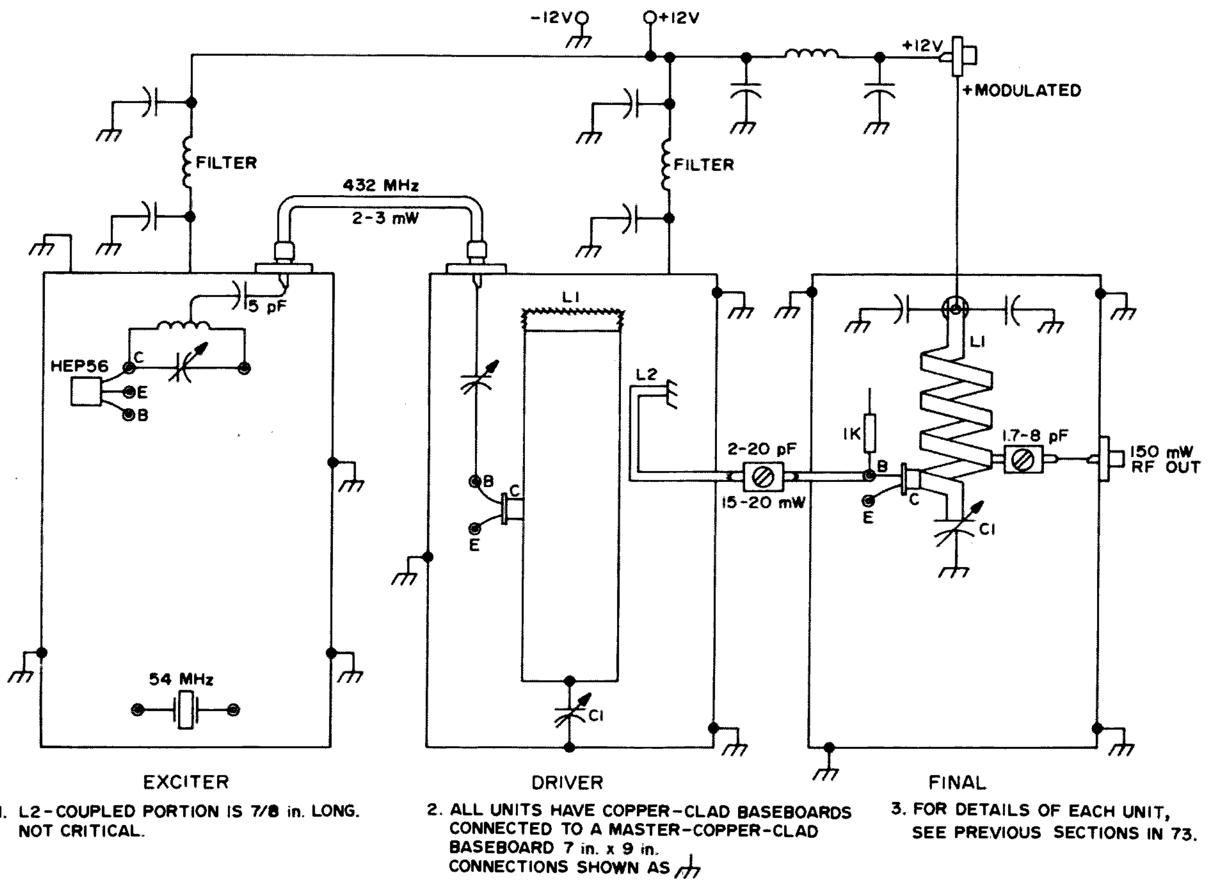

Fig. 1. Schematic of rf section, driver and final. Note that the coupled portion of L2 is about 7/8" long, but is not critical. The three units are all made on copper clad board and connected to a master copper clad board 7" x 9".

bulb really shines in the output jack every time.

The main adjustment points are as follows: The output coupling capacitor, the tap on L1, and the tuning capacitor of the 432 doubler stage in the exciter. The same points on the driver and final stages. Also the emitter resistors of those two stages. So that's about 11 places for adjustments. Actually you don't have to use all of them all the time. Just some of them some of the time.

A few other items you can fix and leave alone: The dc bias was left in the final because with certain amounts of power from the driver the modulation was a little cleaner, and the final tuned smoother. Not too much different with or without.

The use of a choke between the final base and ground was checked instead of the 1K resistor and no difference could be noted, so the 1K was left in as being less troublesome.

Generally the rf input from the crystal exciter to the driver can be tuned up and left alone. The output from the driver seems to be quite important for power, and also for clean modulation and smooth tuning, as you will see in the modulation section.

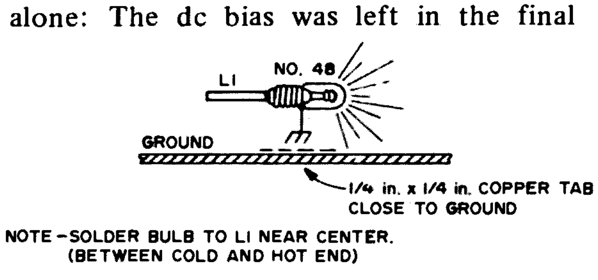

Fig. 2. A No. 48 pilot bulb will indicate the best match at 432 MHz. Solder the bulb to L1 near the center, between the cold and hot end.

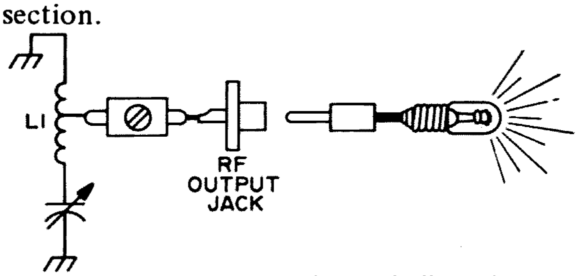

Fig. 3. Plug-in No. 48 pilot bulb load.

I wound up with a series-tuned loop between the driver and final. It seemed to handle best. You can still use connectors and cables and a closed minibox if you want to. I'm just the tinkering type who likes to have knobs to turn and screws to adjust.

About this time the output bulb should be getting pretty bright. You can use the maximum matching method of Fig. 2 and get 150 mW brilliancy, or plug one right into the final output jack as in Fig. 3. This latter will not show up quite as bright, but should be good for 120 mW at least.

As a final word, try for the smoothest adjustments; that is, as you tune either the driver collector circuit or the final one, the output should go up and down smoothly, without jumps and clicks. Or maybe I should say with the least of these, because when you listen to the modulation, there will be places where the modulation is very good and clear and places in the tuning of those collector circuits where the modulation muffles up a little. This is normal for unneutralized stages.

If at any time you don't seem to have any drive, unplug an rf stage and plug in the tuned diode and meter and check for drive out of the preceding stage. The exciter gives about 2½V, the driver 5V, and the final about 6V. This latter jams the diode in its detection curve, so don't worry about only seeing 6V.

So now we have a transmitter rf section.

Modulation

First, unload the final and tune it to resonance. A spark now should show with the old reliable pencil tip test on the hot end of the collector inductance. It is possible to work two states from a New England hill-top with this kind of action. The modulation on the rf should be audible in your receiver. The class B modulator collector current meter should kick up nicely to 50 mils or so. It's always nice to see a little something going on in the meters.

AM people should note that the peak envelope power of a 100% modulated AM transmitter is equal to 2.66 times the average power. I extracted that from the

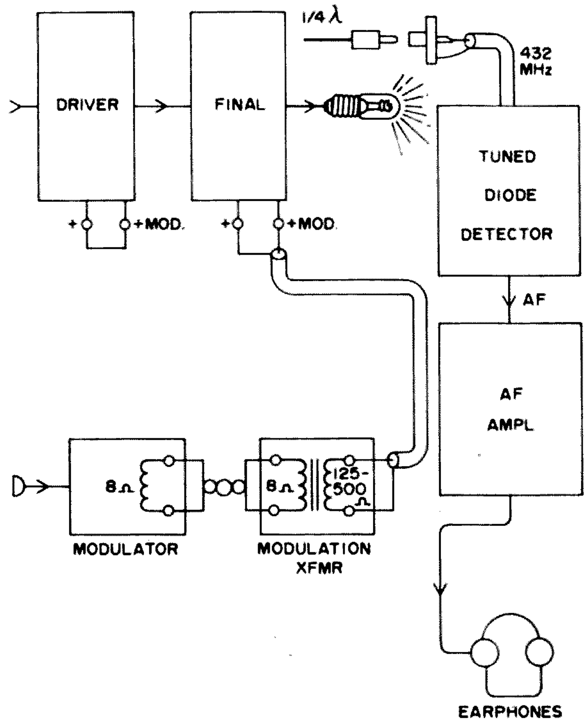

Fig. 4. Modulation test setup for the 432'er.

RCA application note AN-3749, Commercial Engineering, RCA, Harrison, NJ.

As you will know if you have looked into the matter, SSB gets rapidly more costly, complex, and touchy as you go up in frequency from the hf bands of 2 to 30 MHz. Some of the reasons follow: More converters with more crystal oscillators are required. Sideband requirements on UHF call for the usual stability, but multiplied by the frequency increase, such as 432 MHz being over 100 times the frequency of the 75 meter phone band. Only one cycle in a crystal LO can throw your audio out by 100 cycles on 432 MHz. If you try for high-level solid state converters you should not inquire as to the cost. If you do you're in the wrong store. Think it over a little.

Fig. 4 shows the test setup for checking modulation components and circuit. It is best to do this because – as mentioned – with solid state devices you're back in the good old triode days again, and what happens in one stage may reflect back into a previous stage. Of course if you want to try neutralizing 432 MHz amplifiers, go

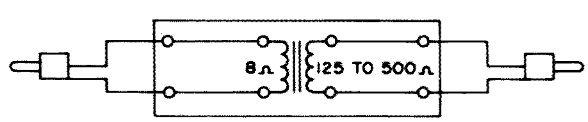

Fig. 5. Plug-in modulation transformer.

ahead. I'm going to try again myself someday "when I have nothing else to do."

It is handy to have the modulation transformers on small planks with plugs ready as in Fig. 5, because they don't work the same, and some of them may drop your dc volts to the final a little. The dc resistance of one of my 500Ω windings was 6Ω.

Stancor has about the best selection of transistor-to-transistor modulation transformers, but remember we're going up to somewhere between ½ and 1W in rf power out pretty soon, with luck, and even then you'll probably want to use a ready-made 3W amplifier like the $7.95 Lafayette which has 8 and 16Ω on the output. If we do get up to 1W that will mean about 2W dc, which means some 165 mils at 12V. This in turn means approximately 75Ω ac modulating impedance for the rf final, following the old and still good formula Zm = E/I x 1000.

There is a Stancor with 8 and 16Ω on one side and 100Ω centertapped on the other, and it's only $3, so that problem isn't hard to solve.

One nice thing about transistors modulating transistors – you don't have to buy much copper!

The Modulator Itself

This time we used a 1W Lafayette job priced at $6.95 because the rf power of our 432'er may increase soon. I just might put in a push-pull stage for fun. The wiring diagram of the modulator is shown in Fig. 6, and a small control panel in Fig. 7, with input jack, gain control, "on" switch, and 8Ω output jack. Note that this little gem is useful as a receiver for listening to your modulation, etc. Fig. 8 shows the top view, with lip below the amplifier level for fastening to a shelf.

Inasmuch as most of these little af jobs use PNP transistors, there is a positive ground side to them. So the front panel is insulated, and the 8Ω output winding connection with the black wire attached is tied to the positive battery side.

This should be cut loose by carving out the piece of printed board plated copper, as in Fig. 9. This allows the use of the single 12V battery or your car battery for the modulator supply as well as for the exciter and rf stages of the transmitter.

You could use one of those little 9V batteries if you're in a hurry, but when you whistle in the mike the amplifier draws 50 mils or more and the poor little battery drops to only 6 or 7V. The two rf stages and the exciter are beginning to draw current also – a total of 80 mils now – with close to 150 mW rf output. And then

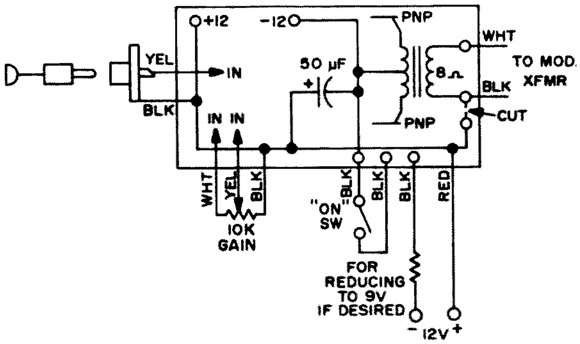

Fig. 6. 1W modulator wiring connections.

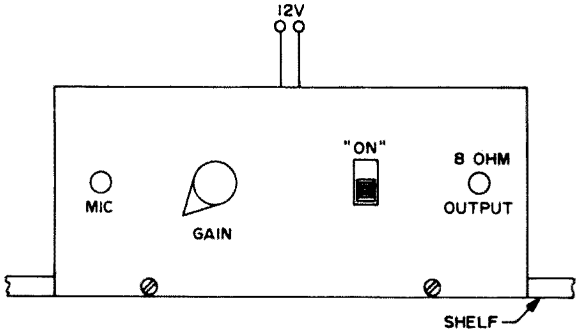

Fig. 7. Modulator control panel.

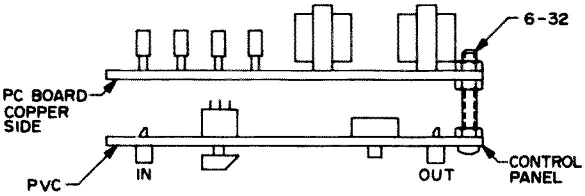

Fig. 8. Modulator top view.

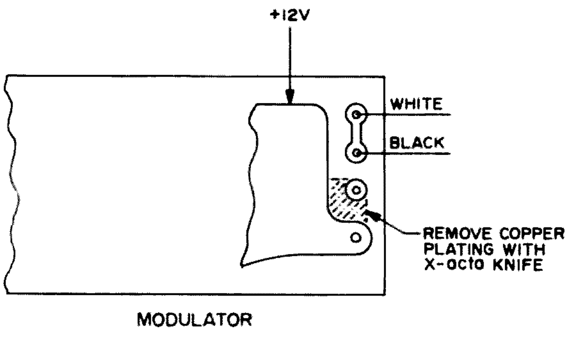

Fig. 9. Details of modulator output connections showing 8Ω output disconnection.

when your class B modulator kicks up to 50 or 75 mils, there is a total of over 200 mils, so forget about those little 9V jobs. You can also forget about the D cells while you're at it! Over 100 mils is *not* good for an ordinary "D" flashlight cell. If you build any kind of portable rig and it runs over 100 mils, don't count on "running all day on ordinary flashlight cells" as some of the Madison Avenue boys so quaintly put it. It'll drop in ten minutes or sooner. The lantern type 6 or 12V Eveready jobs are rated by Union Carbide at 500 mils (maximum).

Checking various items using the setup of Fig. 4, one of the first things I noticed was upward modulation when modulating the driver along with the final. Just for the moment, however, I'm going to leave the modulation off the driver. It seems a little clearer and easier to adjust at first, and also the big deal with more power is coming soon, at which time I will try it again. Some circuits use modulation on the final, the driver, and on a stage called the "pre-driver" as well. You might as well expect to see and use *lots* of amplifier stages on almost any transmitter you make up with solid state devices on UHF. None of that 30,000 Gm transconductance shown by the miracle tube, the World War II number 2C39.

A 10 mF capacitor between the final emitter and ground, which is also the minus battery, seems to give a little more modulation and a slightly better quality to the audible speech.

A little asymmetry can be noticed when checking the full tone quality of the voice under modulation, on the high frequency side of the driver tuning, and on the low frequency side of the final tuning. You can always try neutralization on 432 MHz, if you're the chancy kind.

Adjustments for "BC" type modulation seem a little easier without the driver being modulated. This can be the subject of an interesting series of tests with a DX station later.

That's about it for modulation. All we need now is a beam with some sock to it, and a drive-up mountain.

. . . K1CLL

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The Minirepeater

During the past year or so, I have been doing a lot of work on the G.E. Pocket Mate. I have put quite a few of them on the air, and after a few 2m FM QSOs went by, someone told me it was about time I made a repeater out of one – so I did.

This may seem a little odd to some people, but there are many assets to a repeater using a pocket mate receiver and transmitter. The transmitter, although it puts out only 1W, is reliable, stable, draws very little current and puts out a clean signal with very little white noise over the spectrum. This last feature is very important in any repeater, since white noise is a source of desensitization.

The receiver is sensitive, selective, has good squelch and draws only 5mA of current on standby. It is easy to wire a carrier operated switch to it and it too is reliable.

The entire repeater as described here draws only 40-50mA on receive and 200-250mA on transmit, which makes an emergency battery operated repeater practical. All that need be added are two antennas and the necessary control circuitry, which can either be custom designed or built from earlier articles in 73. Many articles have been written on this subject in the past few years, so I will describe only the basic repeater, which consists of the receiver, transmitter, carrier operated switch (cos), audio circuits, and power supply.

Although I built mine in a 30.48cm x 17.78cm x 7.62cm (12" x 7" x 3") box, the basic repeater could be "shoehorned" into a box of less than a third of this volume. Mine has room for all of the control circuitry (including automatic ID) that is needed before the repeater can be legally turned loose on the air.

Here is how to build the "minirepeater." Although all color codes of wires given here should be standard with all pocket mates, there may be some variances due to repairs made in the field on some units.

Taking the Pocket Mate Apart

The article in the October, 1973 issue of 73 should be read first, as it has some information that is useful here.

First, remove the case and speaker. Next, remove the two small wires that connect the antenna block to the on-off switch located on the receiver audio squelch board. (The audio squelch board is held in place by four tiny screws on the top of the board.) Find the two orange wires that went to the speaker. One goes to the receiver audio squelch board, and it should be left intact. Remove the other one, which goes to the antenna block. Remove the red wire that is connected to the positive battery spring (on the antenna block). Remove the three shielded wires coming from the antenna block. One went to the receiver front end board, to a choke and a capacitor. One went

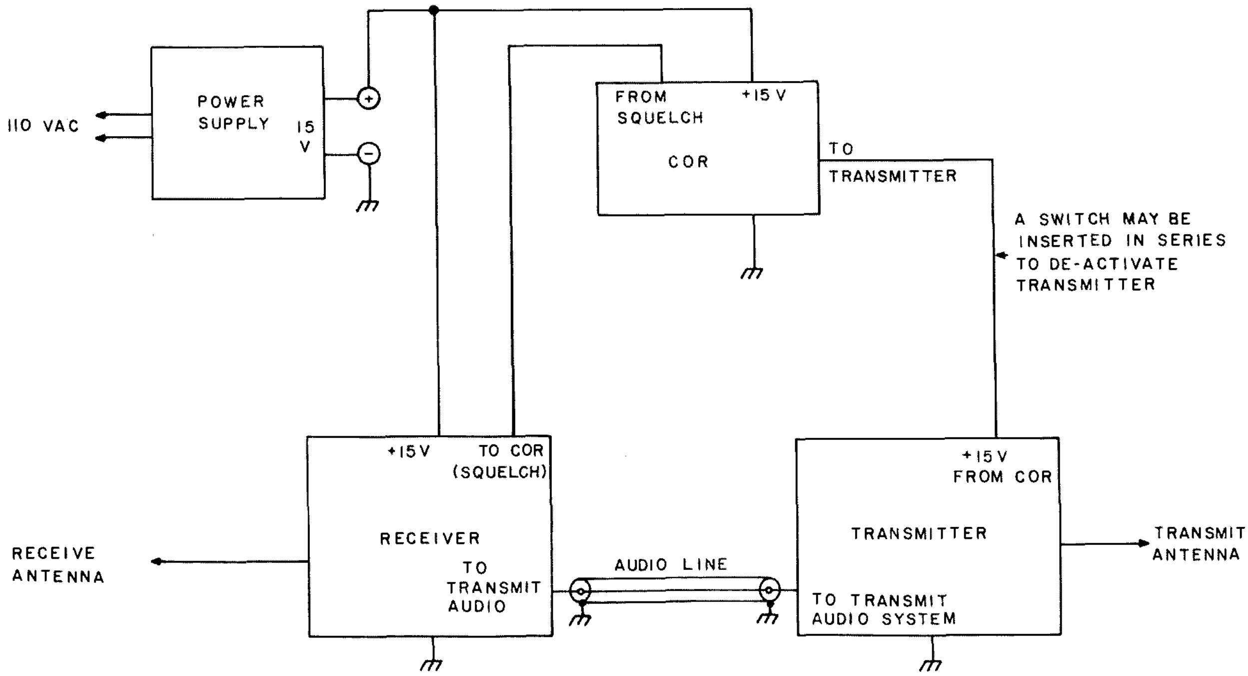


Fig. 1. Block diagram.

to the transmitter audio board. The third went to the transmitter PA module. Find the oscillator switching leads if you have a two channel on it. Two go to the receiver's oscillators and two go to the transmitter's oscillators. *Cut these near the antenna block.* They will be either green and yellow *or* white and yellow. Yellow represents channel 1 and the other color (white or green) represents channel 2. Grounding the appropriate lead will key its oscillator (single channel units have jumpers on the circuit boards instead of these wires). If you desire, you can have a 2 channel repeater if you have a 2 channel pocket mate to begin with.

The antenna block should easily come off the chassis now and be discarded or salvaged for the few parts (including reed relay) inside. Using some metal shears, separate the receiver and transmitter by cutting the metal strip that holds them together. You have finished the tearing apart. Now, here are the modifications. Be careful and use a tiny soldering iron.

Receiver Modifications

Front End Board

Find the 3.3pF capacitor and the 1.2μH rf choke, both located on the foil side of the board (the coax lead removed earlier went to the junction of these two components). Carefully remove both, noting where the two pads on the board came from. Connect a short length of hook up wire to where the choke lead went. This is the receiver B+ lead. Label it. Connect the inner conductor of a short length of RG-174 (or some other small 52Ω coax) to the pad where the capacitor went and solder the shield to a nearby common ground point. Be careful not to melt through the inner insulation. This will be the lead that goes to the receiver's antenna. Solder two small UHF signal diodes such as the 1N914 or 1N4148 back to back from the antenna input pad to ground. The cathode of one and the anode of the other go to ground. These diodes tend to reduce strong signal overloads as well as protect the front end of the receiver. Be sure that you have the oscillator(s) wired so that the receiver will work.

The crystal filter and i-f boards require no modifications.

Audio-Squelch Board

Before attempting these modifications, get a manual to find these points on the circuit board. If you can't locate one send me an SASE and I will send a diagram.

Remove the plastic top cover by unscrewing the earphone jack nut and the two small screws. Remove the four tiny screws that fasten the audio squelch board to the chassis

and *carefully* tilt the board over to gain access to the foil side. The wires soldered to it are easy to break so don't put any stress on them. Solder one small wire to the junction of R-60, R-61 and the collector of Q21. Label this lead "cor," as it goes to the carrier operated relay (or switch). Solder another small wire to the junction of the collector of Q16 and the base leads of Q17 and Q18. This wire will carry audio from the receiver to the audio section in the transmitter. Label it.

Carefully replace the board on the chassis, using the four tiny screws. It is not necessary to replace the plastic cover.

Miscellaneous Receiver Changes

Locate the orange wire that comes from the audio squelch board (the wire that used to go to the speaker) and solder it to one end of a 56-68Ω resistor. Solder the other end of this resistor to ground.

Install the new receive crystal in the same way that the old crystal was soldered. If you have a dual channel receiver you can install two 2m crystals. Make sure that the appropriate oscillator key line is grounded. On single channel receivers a short bare jumper wire is soldered so that the oscillator is keyed all of the time. There are no leads coming from the oscillator to the antenna block on single channel units.

Carefully install the receiver in an rf tight box, connect the cor line, audio and +15V line to .001μF ceramic feedthrough capacitors leading to the outside of the box. The RG-174 coaxial line goes to the pins of either a BNC or VHF type coaxial receptacle. It is important that the box is as rf tight as possible, so that rf can get in *only* through the antenna jack.

Transmitter Modifications and Wiring

The transmitter does not require any modifications other than some work in the audio system. This is described elsewhere in this article and the diagrams give the necessary details.

One thing to make sure of – if you have a 2 channel transmitter, be certain that the key line of the desired channel oscillator is grounded.

The rf output and the B+ input to the transmitter both are tied to the same point on the final power amplifier module. This is where the coax to the relay in the antenna block is tied. Remove this coax and connect the two leads and the indicated rf and dc bypassing components. This permits you to feed 15V dc to the transmitter and get a watt of rf back, both through the same solder joint. It is possible to go into the transmitter's PA stage and separate the two paths, but it is a lot of trouble and nothing is really gained by doing it that way. Simply wire in the rf choke (which can be salvaged from either the reed relay or the input on the receiver front end board), the two capacitors and a couple of ferrite beads, if you have them. These components will do a good job of separating the rf and dc from each other.

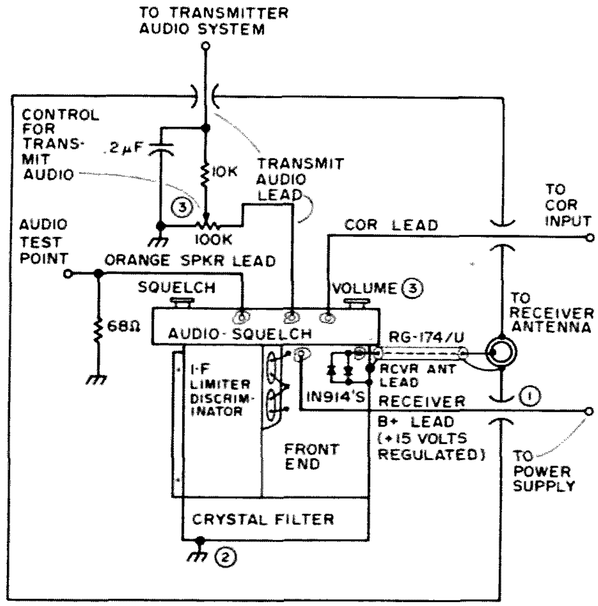


Fig. 2. Receiver.

Notes: (1) All feedthrough capacitors .001 μF. (2) Solder receiver to bottom of box. (3) Volume and compression controls both affect audio going to transmitter audio. (4) Audio enough to drive a 50-100 Ω spea.

The transmitter should also be put in an rf tight enclosure, with .001μF feedthrough capacitors at all external connection points, except at the antenna receptacle, which can be of the same type as used in the receiver. Solder the bottom of the transmitter's PA module to the bottom of the box to give the transmitter a better heat sink.

Receiver Testing and Alignment

Connect a 50-100Ω speaker to the receiver's audio output (across or in place of

the 56-68Ω resistor added earlier) and connect the receiver's B+ line to +15V. Turn the squelch control to "0" and the volume control to "5" or a comfortable listening level. White noise should be heard from the speaker if everything has been done correctly. Tune the receiver up according to the instructions in the October, 1973 issue of 73, or use the following alternate procedure.

Put an ac voltmeter across the speaker terminals and tune *all* of the receiver front end slugs for maximum noise and maximum meter deflection. Do this *after* L10 has been properly set, so that the crystal oscillator will be going. There should be no signal source connected to the antenna jack while tuning for maximum white noise. When you tune the receiver using this method you are tuning all of the stages for maximum gain, which results in more white noise and therefore more ac voltage at the speaker terminals. Final "tweeking" should be done using a weak *on frequency* signal, either from a signal generator or from a distant transmitter. The coils should then be tuned for maximum quieting, or *minimum* reading on the meter.

When properly aligned, the threshold of the squelch control (in the absence of a signal) should be around 3 or 4. If it is significantly higher (over 4½), you have less than normal gain and probably need re-alignment. This is because the squelch threshold is dependent directly on white noise level.

Connect a signal tracer amplifier (or any general purpose medium gain audio amplifier) and a speaker to the audio line that goes to the transmitter audio circuitry. Audio should be present here.

Connect the positive lead of a high impedance dc voltmeter to the cor line, and the negative lead to ground. The meter should indicate 6-8V when the receiver is unsquelched (when audio can be heard in the speaker or when a carrier opens the squelch) and less than a volt when it is squelched. This voltage swing can be obtained by either turning the squelch control back and forth (in the absence of a signal at the antenna input) or by squelching the receiver and then feeding in a weak and on frequency signal.

Transmitter Testing and Tuning

Once the transmitter is mounted, connect a wattmeter and a 50Ω non-inductive load to the rf output jack. A pair of 100Ω, 1W carbon resistors in parallel (with short leads) will serve nicely as a dummy load. Ground the appropriate oscillator keying wire (if you have a 2 channel transmitter board). Hook the transmitter's +15V B+ lead through a push-button on-off switch to a +15V power source, so that B3 (regulated) can be applied to the transmitter by pushing the button. It is also a good idea to have a dc ammeter in this line, so that you can monitor the current drawn. Do not allow the current to exceed 250 mA at any time.

Going by the tune up procedure described in the earlier article, tune the transmitter for 1W output. The drive control pot(s) may have to be adjusted several times – you want each coil set at its peak when the transmitter is delivering 1W. Many pocket mate transmitters are capable of 1.5-1.9W out (or more), but it is not advisable to run this kind of power for any length of time. You may also notice some slight interaction between tuning and drive pot settings, so it is important to tune the rf coils last, after leaving the drive pot in its final position.

If your transmitter will not quite make it to a watt, and the driver coil has just one peak (with the slug all the way in), then you need to add 6-10pF across this coil. See the material concerning this in the "Updating the Pocket Mate" article in the May, 1975 issue of 73.

If your unit has a deviation control, the audio board is wired this way:

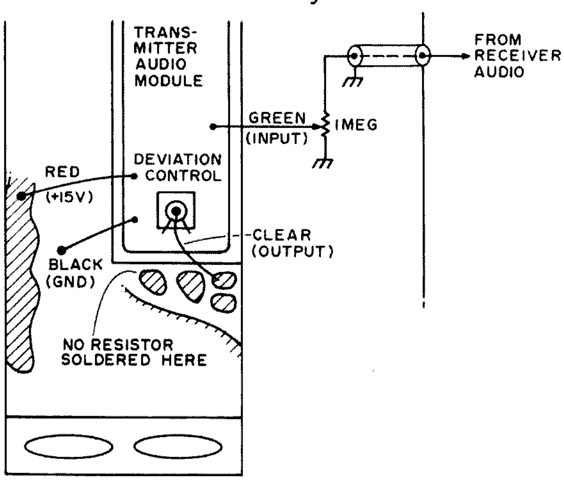


Fig. 3. Transmitter.

Set the crystal(s) on frequency with a counter. Connect a 50-100Ω speaker to the transmitter's audio input. (A shielded wire from the antenna block used to go here.)

The other speaker lead goes to ground. When the transmitter is keyed, listen for it on a receiver tuned to the output frequency. You should hear audio when you talk into the speaker.

The Power Supply

The power supply provides 15V at up to 600mA, which is more than adequate to run the repeater. At most, the basic repeater draws 50-60mA on receive (standby) and 220-250mA on transmit, but it is desirable to conservatively rate a power supply used in repeater service. The output voltage is well filtered, and the regulator holds the voltage drop to better than a tenth of a volt when the repeater goes from standby to transmit. (This power supply can also be used to power a pocket mate walkie-talkie if you want to save on batteries, by the way.)

The component layout is not critical, and a terminal strip comes in handy for mounting the smaller components. The 2N3055 series regulator transistor does get warm and should be heat sunk. I mounted mine on the outside of the cabinet with a metal cover around it, so that it wouldn't accidentally be shorted to the chassis with a metallic object.

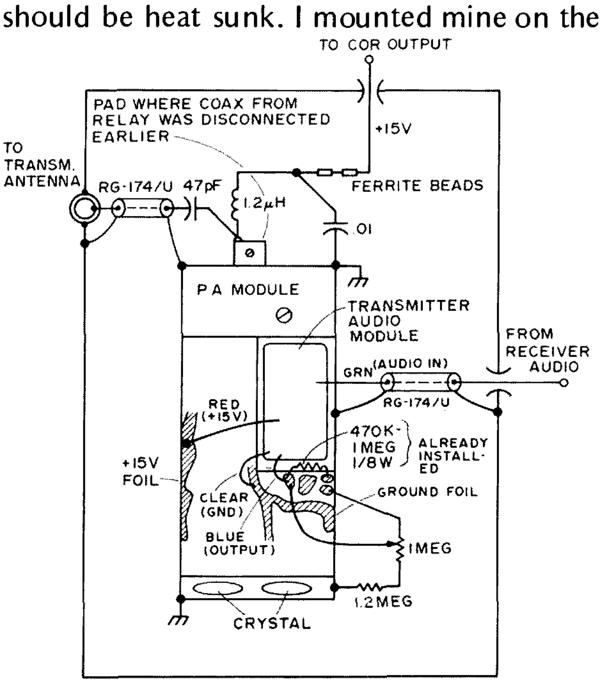


Fig. 4. Transmitter.

***Notes:** (1) Audio wiring shown for transmitters that have no deviation control — see additional diagram for units with audio module that has deviation control. (2) Solder transmitter to bottom of box. (3) 1 meg pot adjusts maximum deviation. (4) All feedthrough capacitors .001 μF.*

If desired, a switch can be installed to provide for emergency and/or portable operation. It would remove the output of the power supply going to the repeater, and replace it with a 15V battery. It is also possible to wire in a relay so that this changeover would take place automatically if the 110V ac power source were to fail. A diagram is included to show how this is done. If desired, a trickle charger can be left on the battery to keep it fully charged until it is needed.

Carrier Operated Relay Construction and Checkout

The carrier operated relay (not really a relay, since transistors do all the switching) is what turns the transmitter on when the receiver's squelch is broken by a signal. Relays are often a source of trouble, and that is why I used transistors instead.

I built my cor on a small piece of perforated glass epoxy board since it is probably the quickest and easiest way. Layout is not critical, as there is no rf in this circuitry.

The amount of time the transmitter remains on after the received signal disappears is determined by the size of the electrolytic capacitor on the collector of Q2. This "carrier tail" can be lengthened by increasing the value of this capacitor. The value shown gives a transmitter drop out delay of about 1 second.

Q1 through Q4 can be any good NPN switching transistor such as a 2N3904, 2N3565, or 2N2222, but the beta must be reasonably high. Q5 is also a NPN device that must be able to easily handle 20-25V at up to 1A. These ratings are excessive of what the repeater will demand, but it is best not to push this transistor to its limit. A 2N3054 is a good choice to use here.

If you like relays, one can be used in this circuit. Its coil goes in the place of the 5.6kΩ resistor that goes from the emitter of Q5 to ground. A diode should be put across the coil to protect Q5 from transient spikes. A 1A (at least), 50V device, such as a 1N4001, is adequate. The cathode (banded)

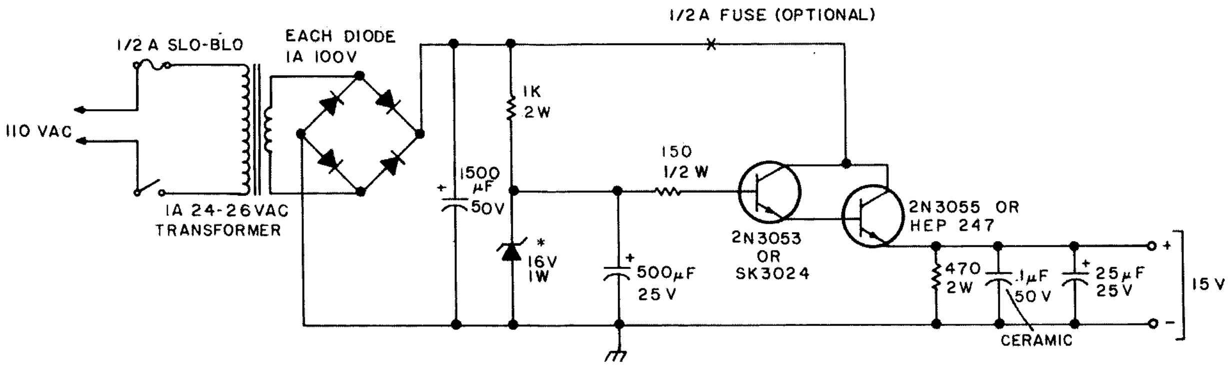


Fig. 5. Regulated power supply.

**Choose this Zener diode for an output (at the terminals) of 14.5 to 15.5 volts.*

end goes to the emitter of Q5. The relay can be used to switch 15V to the transmitter as well as to switch other circuits you may wish to add.

The input to the cor board comes from the audio squelch board. This lead does not have to be shielded.

Once the cor board is built, it should be tested by itself. Connect it to a 15V power supply and ground its input lead. Close to zero voltage should be present at the output. Remove the ground lead on the input and connect the input lead to a variable 0 to 15V power source. Turn the input pot on the cor board to maximum sensitivity (so that the wiper arm is nearest the input connection). Turn the pot on the variable power supply back and forth *slowly*. The output of the cor should indicate 14-14.5V when a small voltage is present at the cor input.

Turn the power source to zero. The cor output should be near zero within a second or so. Quickly turn the power source to 10-15V. The cor output should jump to 14.5-15V. Quickly turn the power source back to zero. The cor output should remain at 14.5-15V for approximately a second, and then fall to near zero. If you wish for this time to be longer, increase the size of the electrolytic capacitor.

Later, after you have the receiver working properly, connect the cor line from its audio squelch board to the cor input. Apply 15V to the power leads of both, and put a dc voltmeter on the output of the cor. Almost no voltage should be present when the receiver is squelched. Turn the squelch control into the "white noise" range. The output of the cor should jump to 14.5-15V, and should remain there. Turn the squelch control back again. After a second or so, the cor output should drop to near zero again.

Audio Circuits

The components that are wired between the receiver's audio squelch board and the transmitter's audio module provide a proper audio match from the repeater's receiver to its transmitter. Two different circuits are shown and the one to be used in each individual case is determined by which type of transmitter audio module is used in your transmitter. The diagrams are self-explanatory, so no details will be given here. Just be sure to use shielded wire in the places indicated.

The orange wire coming from the area near the earphone jack on the audio squelch board (one of the two orange wires that used to go to the speaker) and that now goes to ground through a 56-68Ω speaker will have receive audio across it. If desired, a 50-100Ω speaker can be used in place of it and it will serve as a monitor so that you can hear the received signals directly. One thing to remember – the volume control on the audio squelch board affects the audio being fed into the transmitter as well as the audio heard in the speaker.

The pot added to the transmitter, the pot already on the transmitter audio board (deviation control – if yours has one), the pot added to the receiver, and the volume control *all* interact and affect the audio that the repeater transmits. The 0.2μF capacitor in the circuit limits some of the high frequency components in the audio going from the receiver to the transmitter. Experimenting with the size of this capacitor as well as the settings of the pots will produce

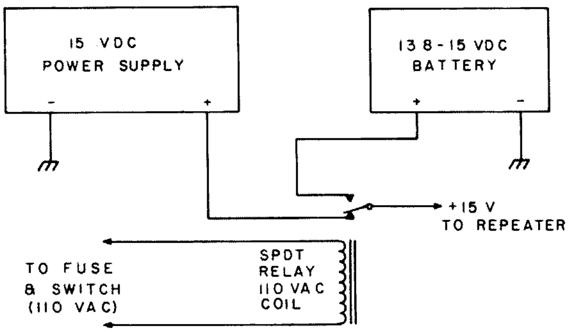


Fig. 6. Emergency power option. The battery can be most any type, and its amp-hour rating will determine how long it will run the repeater before it is discharged. If a rechargeable battery is used, a trickle charger can be left on it at all times so that it will always be at or near full charge, and ready to go when needed.

different characteristics of audio in the system. The pots in the receiver section can be set to give some clipping action, while those in the transmitter will tend to set maximum deviation limits. It is possible to get an almost exact reproduction of audio so that little difference is noted between audio heard direct and audio heard through the repeater. A little time spent making these adjustments will pay off in very good audio quality.

Once you have the receiver and transmitter working properly, wire up the audio circuitry and turn the receiver and transmitter on at the same time. If you have the cor and all the rest of the associated circuits wired and working properly, the transmitter should key up when the squelch control is turned towards zero (you may want to back the drive pot back some during the following tests so that you will be putting out just a few milliwatts). Listen to the transmitter's output signal on another receiver. As you turn the various controls in the audio circuitry, you should hear different levels of white noise coming through. Try talking through the repeater with another transmitter. You should hear yourself in the monitor receiver. Turn the squelch control back to mute the repeater's receiver. You should be able to key up the repeater, hear your audio through it and have a carrier tail for about a second after you stop transmitting through it. The transmitter should drop *completely* off the air after this carrier tail. It should also key up *promptly* after the receiver's squelch is broken.

Putting it Together

Once you are sure that everything is working properly, assemble the complete system in its cabinet. I used a bud chassis box with a piece of sheet aluminum for a cover. Use coaxial cable where indicated, and be sure that the receiver and transmitter compartments are as rf tight as possible. The main cabinet need not be rf tight. In fact, you don't have to have the cover on while it is operating.

You may wish to add the necessary control and automatic identification circuitry that is required to put it on the air as a licensed repeater. Several excellent articles on these circuits have been written up in 73 in the past.

Final Adjustments

The cor circuitry should be adjusted carefully. Setting it too close to the threshold will be unsatisfactory because very weak (and unreadable) signals will be able to key up the repeater. If you have any desensitization, this problem will be accentuated, as a weak signal will sound worse as soon as the transmitter comes on in the repeater. Setting it too far the other way is also undesirable because it would take a very strong signal to be usable. "Desense" also makes this problem even worse. When the cor is properly adjusted, a signal of around .3 to .4μV should easily bring up and hold the repeater. If you have desense, the repeater will "motorboat" on and off in the presence of a weak signal. You will get *substantial* desense unless you use two antennas a *great* distance apart, or use some correctly tuned cavities to eliminate it.

One way to get a feel of how much desense you have is to set the repeater up with the desired antennas and cavities, if you have any. Have a rf signal generator with a variable attenuator and a small whip antenna a short distance away from the repeater's receiver antenna. Tune the generator to the repeater's receive frequency. Listen to the audio in the repeater's receiver speaker. De-activate the repeater's transmitter and adjust the attenuator's output to get a reasonable amount of quieting. Actuate the transmitter and see how far *up* you have to

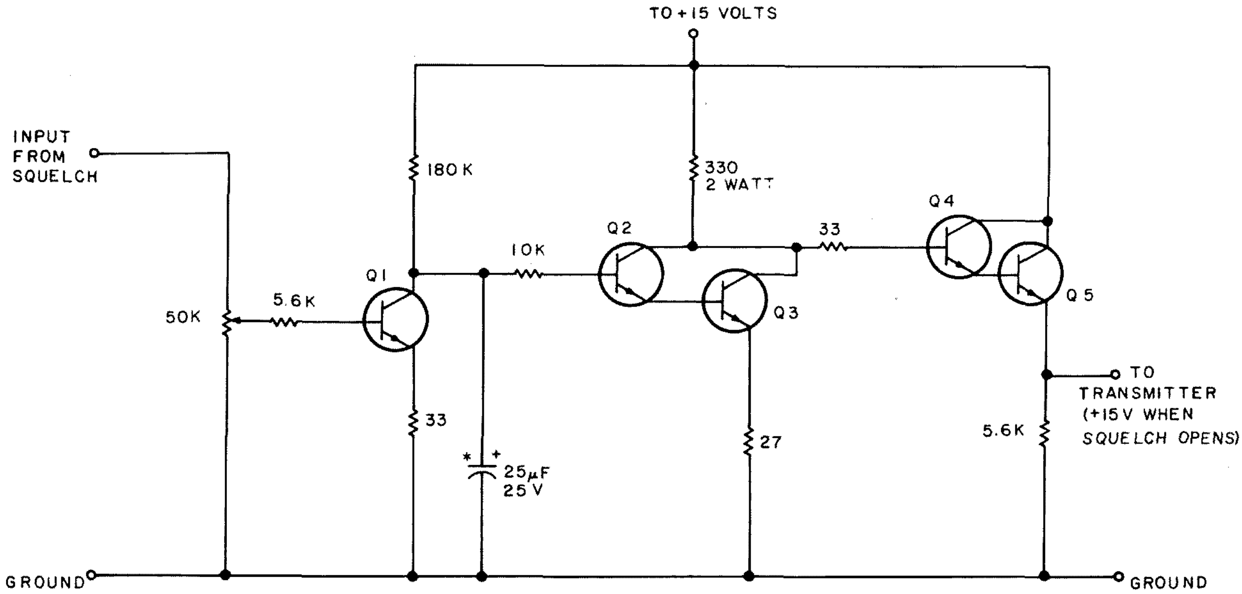


Fig. 7. Carrier operated relay.

Q1 – Q4 Any NPN switching transistor similar to 2N2222, 2N3904, etc. Q5 2N3054 or equivalent. Make this larger for longer delay and smaller for shorter delay. 25 μF here will hold transmitter keyed for approximately one second after the signal keying it disappears. (Repeater will have a one second "carrier tail.")

turn the generator's output until you have the same amount of quieting (an ac voltmeter across the speaker is useful here). The less desense you have, the less you will have to turn the attenuator. If you have no desense, turning the repeater's transmitter off and on will make *no* re-adjustment of the attenuator necessary. If you do have appreciable desense, you will notice that the repeater's transmitter will "motorboat" on and off over a range of settings on the generator. At the low end, the repeater will drop off and stay off. At the other end it will stay on and the transmitted white noise will lessen as the attenuator is turned up.

Normally, the pot on the cor board is left at or near maximum sensitivity and the actual cor sensitivity is set by the squelch control. The cor is actually squelch operated. That is, the transmitter is activated when the audio gate is opened by the squelch in thy receiver.

The audio circuits can be adjusted best by having someone transmit to you through the repeater while you listen to him on another receiver. Try comparing his audio as you hear him through the repeater to the way he sounds direct without it.

Finally, using a wattmeter, frequency counter and signal generator, retune the transmitter for 0.9-1.0W into the antenna system, and make certain that both the receiver and transmitter are on frequency.

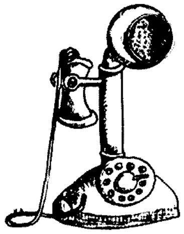
Operation

I have had surprisingly good results using a couple of "Ringo" antennas spaced apart both horizontally and vertically. There will be some desense unless they are spaced a considerable distance apart (or unless you use some cavities). But you can live with some desense if you want this repeater to be compatible with stations running 10W or more. It is possible to use a duplexer and one antenna, but you will be lucky to get a ½W output. Many interesting articles can be found on the topic of antennas and cavities for repeaters, and they should be read for optimizing the operation of this repeater.

Another attractive feature is that the repeater can be made very compact and portable – and it can run for hours on a battery. Higher power could be added with another power transistor or two, but this would detract from some of the novelties of the system.

I plan to get a license for mine, so look for WR4???/4 from the top of Mount Mitchell at 6600 feet some weekend.

. . . WB4DBB



Basic Telephone Systems
Conclusion

Spenser Whipple, Jr.
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Inside Ma Bell

The automatic couplers we have described so far would be ideal for a repeater autopatch or possibly an answering machine or automatic dialer (although we'll mention others specifically designed for answering machines and dialers later), but to connect just a few extension phones we need a bit more. We need a battery to provide power for the carbon mike, a series relay to detect when the extension goes off hook and when it dials, and also a 20 Hz ringing generator to ring bells.

While it is no great problem to build just this, if all you want is a telephone-company-approved way to connect 10 extensions in your 25-room mansion, you can order the STC Voice Connecting Arrangement for $5.80 a month plus $25 installation.

As shown in Fig. 12, the STC has only one varistor but two transformers. As usual, the main PC board (KS-20721) is used in almost a dozen different couplers and has a number of jumpers which can be hooked up in many combinations.

On the right-hand side we see that a +21 volt supply is connected to the CT output through one transformer winding, while ground is connected to the CR lead through a resistor and another transformer winding. This provides the talking power to the extension phone, and the voltage drop produced across the resistor when the extension is off hook is sensed by the control circuits and used to operate the line relay. When you pick up the extension phone, the line relay closes and puts the coupler on the line. As you dial, pulses are repeated by the line relay.

The ringing circuit is also interesting. As usual, a ring detector across the line detects the 20 Hz ringing and pulses a relay. But usually the relay pulses at 40 Hz, once on each half cycle of the 20 Hz. In this case the circuit is set up so the ring relay pulses at only 20 Hz. The ringing generator is simply a dc-to-dc inverter which changes 21 volts dc into about 120 volts dc. The ring relay contacts then change this into 20 Hz ac by

reversing the polarity at a 20 Hz rate (remember, an x means a normally open contact, while the short line means a normally closed contact). The resulting ringing signal is then applied to the CT and RV1 leads.

As mentioned in the figure caption, any number of extensions can be hooked up, but the ringing generator can only feed a maximum of three bells. This means that all the non-ringing extensions need only two-wire connections via the CT and CR leads; unfortunately the three ringing phones require a three-wire connection. This is done in order to keep the coupler simple, as it is a bit messy to test for dc continuity (off hook) on the tip and ring leads at the same time (there is 100V ac there) as it is normally done at the CO.

For some reason this coupler has the ring (CR) and tip (CT) leads mixed up. In Fig. 12, we see that the ringing generator applies its voltage between the CT (tip) lead and RV1. Since the ringer goes between the red and yellow wires in the extension (see Fig. 2), that means that the red wire has to go to the tip and the green to the ring side of the line. A rotary dial phone won't mind this, but a Touchtone phone won't work like this. You have to move the black ringer wire from the L2 terminal to the L1, and then connect red to ring (R to R) and green to tip, as normal.

Let's just quickly cover some other couplers you might be interested in:

The GC2 is just a plain ring detector, similar to the one in Fig. 7, which closes a relay contact when there is ringing voltage on your line.

The CTD is a toll-denial relay which senses long distance calls.

The C1V and HZM couplers monitor a line and provide a signal when the line is busy. Intended to allow customers to run timers or pen recorders to measure line usage.

The CEZ and CEZAW couplers allow you to make conference calls if you have two or more lines. Actually, just shorting the two lines together (tip-to-tip, ring-to-ring) would work just as well.

The CEK coupler, along with an extra line and some changes in the CO, allows you to have a message unit counter on your premises to keep track of your own message units. Probably intended for hotels and motels, which charge guests by the call.

The RDL, RDM, RDMZR, RDMZY and RDY couplers are various versions designed for telephone answering machines or for automatic recording (dictating) machines. Depending on the model, you get one-way or two-way transmission, volume limiting, or automatic cutoff when the message stops.

The RCT and RCW are couplers for recording a two-way conversation. The RCT automatically generates a beep every 15 seconds, and the RCW doesn't. I think only law enforcement agencies can get the RCW. The RCT runs $2.46 a month and $12.30 installation, while the RCW is only $1.23 a month and $12.30 installation. The RCZ is similar.

The RTT and RC1 are similar, but only beep. Used with a customer owned call duration timer, they beep to tell you you've been talking too long. The RTT sends the beep to both parties, while the RC1 only beeps the local party.

The SU7 and SU7QW (at $3.85 a month and $25 installation) allow outward dialing only for automatic dialers.

Finally, there is a group of couplers designed for burglar and fire alarm systems. Real fancy alarm systems may have a private line running straight to a police station or private detective agency; a somewhat cheaper alternative is to get an automatic dialer which dials a number and then feeds in a tape-recorded message. That's where these couplers come in (although burglar alarm installers often connect a dialer directly without a coupler.)

The CAU coupler ($4.36 a month and $14.47 installation) allows an alarm dialer to seize the line (and at the same time disconnects any other telephones on the line to prevent a burglar from interfering with the call), dial a call, and then play a pre-recorded message. It provides only one way outgoing audio transmission. An SU6AQ coupler (at $4.25 a month and $25 installation) is also for alarm systems but allows two-way voice and tone transmission; it has a ring detector and is actually built just like the STC coupler (Fig. 12) but without a ringing

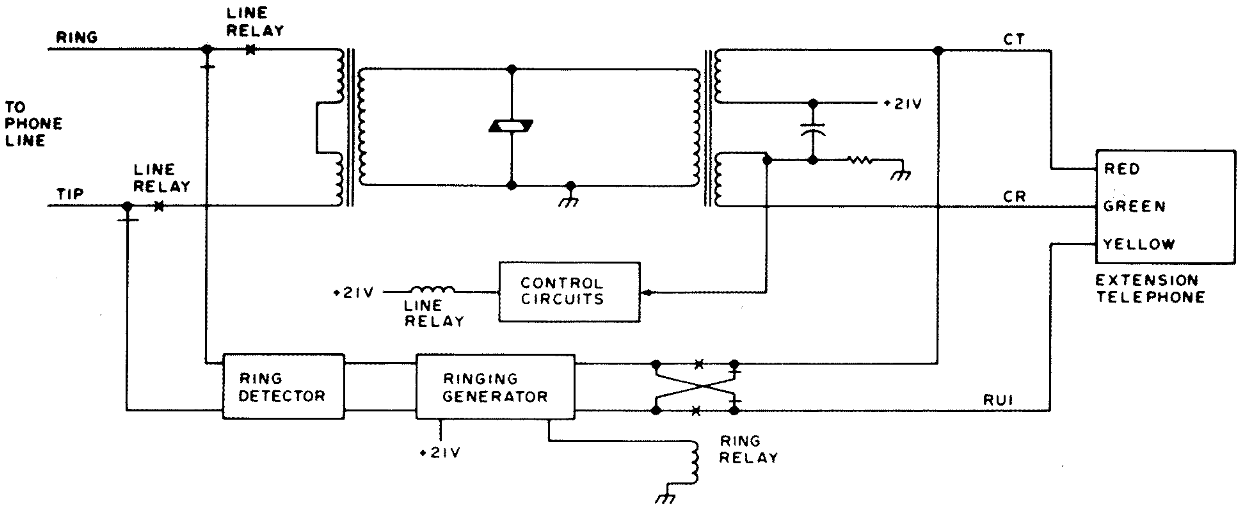


Fig. 12. Simplified diagram of STC Coupler, when equipped with options W, Z, S, P and X. Any number of extension telephones can be connected, but the ringing generator can only drive three bells.

generator so it could be used for extensions but not to ring them. The STS ($5.65 and $25 installation) is the same as the SU6AQ but with an added volume limiter for received audio.

Of greater interest, especially for simple (though expensive compared to a homebrew version) control of things like repeaters, is the SU4 or SU6 coupler. Both are similar to the CAU with the SU4 being one way and the SU6 being two way. In normal alarm service, both of these allow an alarm to dial out and send a voice or tone message. But, in addition, they allow remote testing of the alarm.

They work like this: To test the alarm, you need either a 1475 Hz tone generator or a Touchtone phone (which can generate a high-group tone of 1477 Hz if you simultaneously push two buttons in the right-hand column (3-6-9). You call the SU4 or SU6 coupler from the outside. The coupler detects the 20 Hz ringing, answers the call, and automatically sends a pulsed 2125 Hz tone back to you. Now it waits for your 1475 Hz tone; if no such tone comes, it simply waits 20 seconds and hangs up. If it gets 1475 Hz, it gives the alarm (or what-have-you) a relay contact closure, and changes the pulsed 2125 Hz to a continuous tone to confirm receipt. By appropriate relay closures the alarm can now silence the 2125 Hz, send out audio (and in the SU6, receive audio), or wait for further 1475 Hz signals. Altogether a very interesting gadget.

It is fairly hard to get information on these and other couplers from your local telephone company. For each coupler there is a Technical Reference supposedly available from "the local Telephone Company Business Office or the Marketing Representative." Unfortunately, the gals in the Business Office don't know what you're talking about, and the marketing reps have unlisted numbers. If you don't ask for too many at a time, I've found that the best way to get Technical References is with a neat letter (preferably on letterhead) to the Engineering Director, Transmission Services, American Telephone and Telegraph Co., 195 Broadway, New York, New York 10007. Publication Pub-40000 is an index of the Technical References available and is a good starting point. These publications are intended for customers and so they will tell you what the coupler will do and how to use it the way they want it used, but not what's in it. The latter information (on couplers and most other telephone company equipment and procedures) is contained in BSPs (Bell System Practices). These are "cookbooks" for installers and repairmen which tell them anything they need to know; I wouldn't be surprised if there is a BSP somewhere telling them how to climb a ladder or drive a truck.

If you've been reading carefully so far, you've probably been wondering who these phone phreaks are whom I mentioned a few thousand words ago. We've actually alluded to two other related items, the magic signalling frequency of 2600 Hz, and billing for very short calls. Maybe now is a good time

to explain. But first a word of caution: The following technical information is a matter of public knowledge and has been previously published in many places (see, for example, Esquire for October 1971 and Ramparts for June 1972 and October 1972.) Although you are free to read it and marvel at the perseverance of a group of blind kids *don't try to use it yourself.* The phone companies are very uptight about the following subjects and don't hesitate to prosecute anyone they catch using the techniques we're about to describe.

Sometime in the late sixties, a few blind kids interested in the phone company happened to meet at a camp for the blind. By pooling their knowledge and talents (excellent hearing and musical pitch, as well as lots of free time to experiment) they were able to develop a number of techniques for placing and receiving free long distance calls. Elated with their knowledge, they got great kicks out of routing their calls through foreign countries and even all around the world. Some of them even got to be quite famous — ever hear of Captain Crunch and his magic whistle, which just happened to whistle at 2600 Hz?

The simplest of their techniques involves the so-called black box, which allows you to receive free long-distance calls (calls for which the other party is not charged). It works like this:

When someone calls your number, the dial system connects his phone to your phone and then starts ringing your bell. If you had a way of coupling to your line *between the rings* in such a way that you didn't complete the dc circuit, you could actually talk to him without his being charged for the call, because as far as the CO is concerned, there is no dc connection and therefore there is no answer at your end.

Of course, the 90 volt ringing signal makes it tricky, because it can blow your eardrum out. Wouldn't it be nice if you could stop it? Then you could talk continuously. But we mentioned earlier that the call doesn't register unless it lasts a second or so. By picking up and then slamming down the regular telephone set as fast as possible (or having a ring-detector relay as in Fig. 7 with its n.o. contacts right across the line, which puts a very fast short circuit across the line), you get the bell to stop! That's all there is to the Black Box.

Somewhere along the line, somebody came up with an even neater version: if a 10k resistor is placed in series with the phone, enough dc current passes through to provide talk current for the carbon mike, but not enough to trip the CO relays. A $1\mu F$ capacitor or so across the resistor is needed to let audio through, as well as an SPST switch to remove the resistor when not needed. On a 500 style telephone the extra capacitor is not even needed if the 10k resistor is placed between the F and RR terminal on the network (see Fig. 3) and the switch is placed in series with the pulsing contacts of the dial.

Before continuing, let us again stress the admonition that you not use any of these ideas — they are presented here only for your own information. As mentioned earlier, widespread usage of any of these techniques could cause havoc and the telephone companies are determined to catch any users as fast as possible. They are hard at work to develop equipment which would identify and trace such calls, and a number of people have already been prosecuted. For example, rumor has it that black boxes can be detected on calls longer than a minute or two in duration.

Another device is popularly called the Red Box. If you remember the old-style coin phones with three coin slots on top (nickel, dime, and quarter), you may remember the sounds they made when you dropped a coin in — two bells inside made a ding on a nickel, a ding-ding on a dime, and a bong on a quarter. Unfortunately, some unscrupulous individuals either looted a pay-phone and stole the bells, or tape-recorded the sound, and then used this to fool operators into thinking that calls were being paid for. To counter this, a new coin phone was designed which used an electronic oscillator, rather than a bell, to signal the type of coin inserted. When the oscillator is on, the earphone is muted so you can't hear it, and an electronic gizmo indicates to the operator how much money was inserted.

The Red Box is simply a 2.2 kHz oscillator, switched on and off electronically just

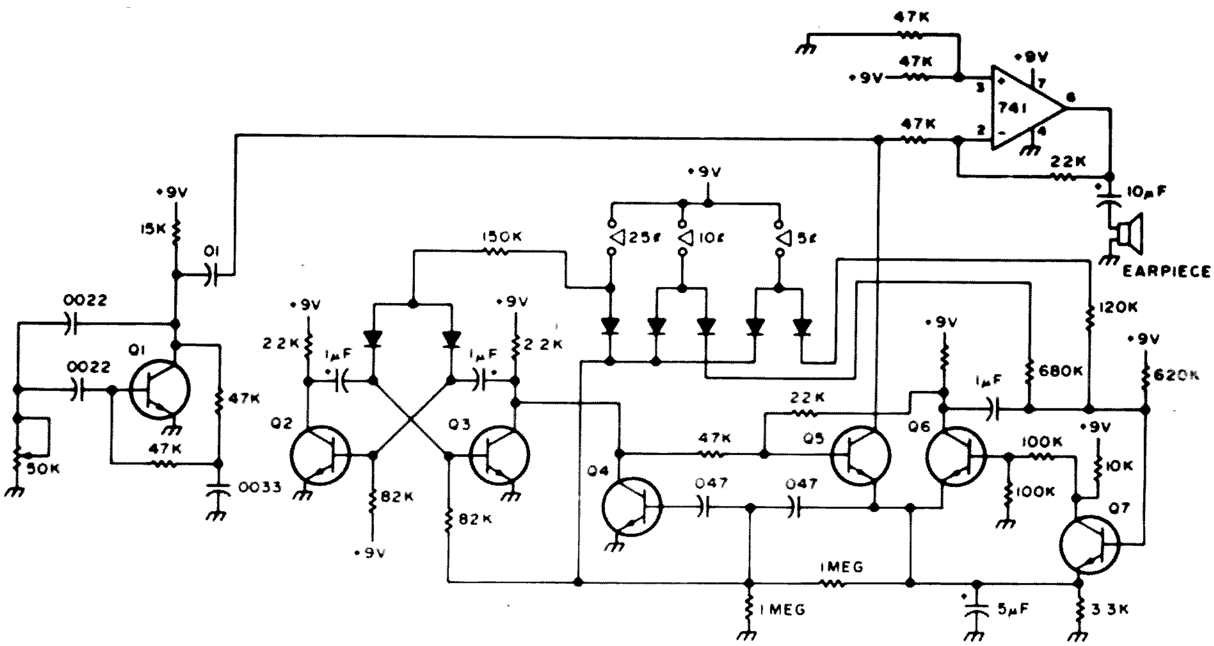


Fig. 13. Early version of the Red Box, circa 1972. Transistors are NPN silicon (2N2222 or HEP55), diodes 1N914 or similar, resistors ¼ Watt, 5%. Small capacitors are high quality mylar, epoxy, or polystyrene.

like the one in the payphone, with a small speaker to couple it to the mike. The pulses are coded as follows:

Nickel – One 60 millisecond pulse;
Dime – Two 60 ms pulses separated by 60 ms;
Quarter – Five 35 ms pulses separated by 35 ms.

Some of the phone phreaks must be fairly knowledgeable about electronics as the Red Box circuits are reasonably modern – even using ICs.

Fig. 13 shows an early version of the Red Box. To see how it works, suppose the 10¢ button is pushed. This starts an astable multivibrator (Q2 and Q3), which feeds Q5, turning it on 60 ms, and off 60 ms. Q5 shorts the output of Q1, the 2.2 kHz oscillator, generating pulses of tone. Q6 and Q7 are a timer that lets exactly two of these pulses reach the IC, which feeds a speaker. True to form, the phone phreaks prefer to use a 600 Ohm earpiece (borrowed from a phone handset) rather than buying a speaker.

A later version, in Fig. 14, is quite a bit more sophisticated. IC1 is the timer, while IC2 is the astable.

The most famous (and most powerful as well as most dangerous) is the Blue Box. Because it goes to the heart of long distance switching systems, let's talk about long distance calls for a while.

All the way at the beginning of this article, in Fig. 1, we showed your local CO as being connected to other local subscribers, other COs, and also to long distance switching centers; the latter are called "tandems."

There are many COs in any city, just as there are many tandems throughout the country. It would clearly be impractical for every CO to be connected directly to every other CO, and likewise it's not practical for every tandem to be connected directly to every other tandem. This means that in a few instances (such as over common routes – say, New York to Chicago) a long distance call may be routed directly from a tandem near New York to another tandem near Chicago. But many times a call may have to be routed through several tandems – Chicago to San Diego, for instance, might go through Los Angeles. Because of this, the tandems are so arranged that if they cannot route a call directly (either because all direct lines are busy, or else there are no direct lines) they simply route a call some more indirect way. Also, if a tandem office receives a call not intended for it, it just relays it on in the right direction.

Whenever there is a direct connection

between tandem offices, that may consist of many lines, carrying many simultaneous conversations. Actually, we shouldn't use the word "lines," because in reality these conversations may be multiplexed onto coaxial cables or microwave links. This means that dialing can't take the form of dc pulses, as in your home phone, but always consists of pairs of tones called multi-frequency or MF tones, similar to Touch-tone dialing. The only difference is that the frequencies are different from those used in Touchtone dialing, as follows:

Digit	Frequencies (Hz)
1	700 + 900
2	700 + 1100
3	900 + 1100
4	700 + 1300
5	900 + 1300
6	1100 + 1300
7	700 + 1500
8	900 + 1500
9	1100 + 1500
0	1300 + 1500

In addition, 3 additional signals are:

KP (Key Pulses)	1100 + 1700
ST (start)	1500 + 1700
Disconnect	2600

Another aspect to keep in mind is that it takes quite a bit of equipment to establish a connection, but little equipment is needed to maintain it. To avoid useless duplication, the equipment used to set up a connection (called a sender) is shared among many lines. Whenever a sender has a call to handle, it searches for an idle line; when it finds one it latches onto it and then forwards the call. As soon as it is finished, the sender leaves the call and goes to service another call. To mark an idle line, the tandem office feeds a 2600 Hz tone into it.

Now let's examine a typical call – suppose you place a call from New York to Los Angeles. You pick up your phone in New York and dial area code 213 for Los Angeles, followed by the seven-digit number. That number is stored in a register in your CO, and now two things happen. First, an accounting machine called CAMA – Centralized Automatic Message Accounting – keeps track of your call. This is done by punching your number, the time, and the number you dialed into a paper tape (which will later be fed to a computer). Your CO now sets up a connection with the nearest tandem office and sends the area code and number you dialed to the tandem. In the tandem a sender decides on the route, and starts looking for an idle line. Suppose there is an idle direct connection from this tandem to the one in L.A. Since this line can be used for calls in either direction, both tandems are marking it as idle by feeding 2600 Hz

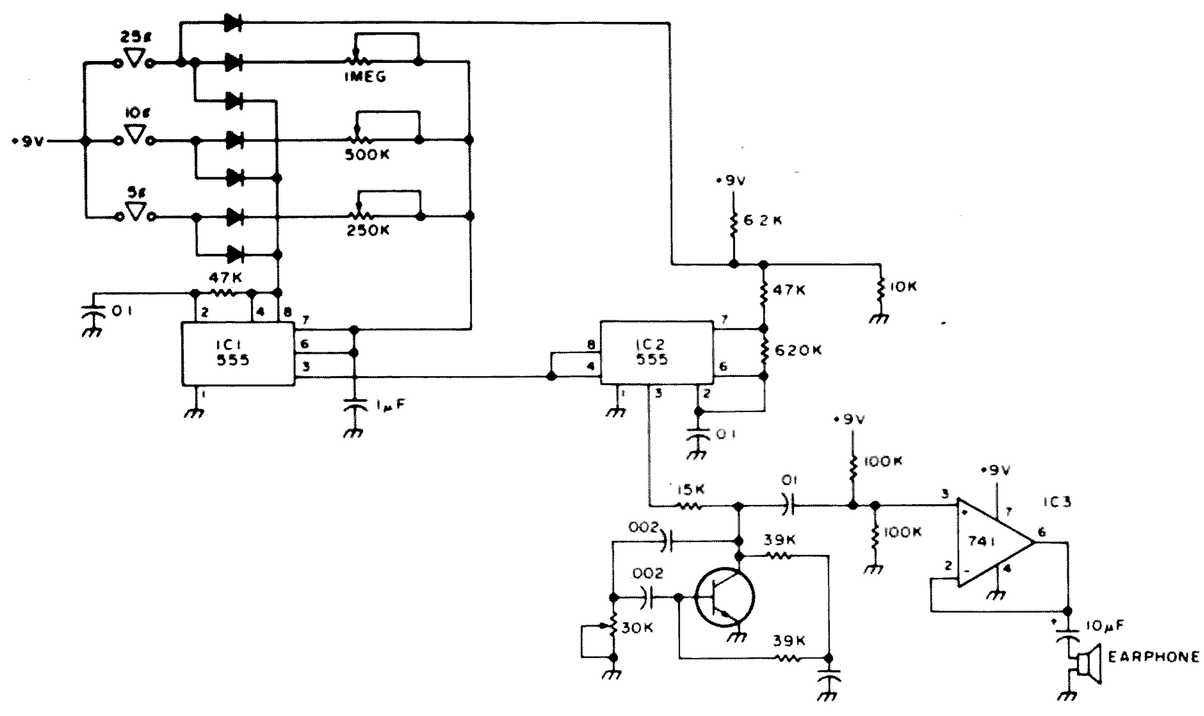
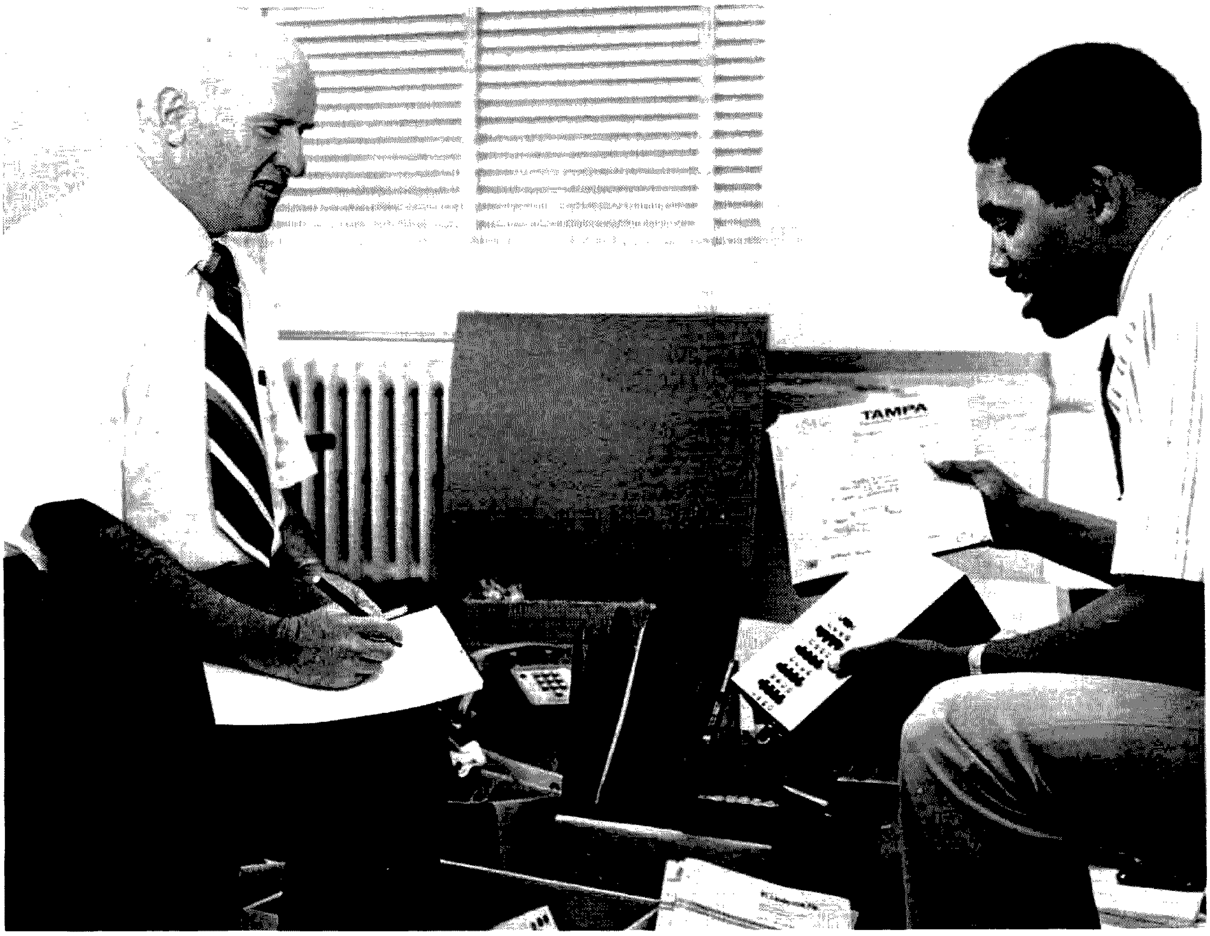


Fig. 14. Later version of the Red Box, circa 1973.



Chester County (Pa.) Detective Ronald Johnson (right) displays an illegal "Blue Box" used to bypass toll charges and seize long distance telephone circuits. Johnson and Chief of County Detectives Eugene Sharpe (left) were part of a law enforcement team which raided several Chester County residences of suspected "phone phreaks." Four persons were arrested in connection with charges ranging from toll fraud to impersonation of telephone company employees and, in one case, wiretapping. Authorities said "several carloads" of illegal equipment were confiscated, some of which is shown here.

into it, one from each end.

Now the sender finds this idle line. First, to prevent L.A. from trying to send a call in the opposite direction at the same time, the New York sender removes its 2600 Hz tone. This tells L.A. that a call is about to come on this line, and so L A. assigns an incoming sender to it. The New York sender sends the 213 area code and the 7-digit number to L.A., using the MF (multi-frequency) tones described earlier. The code is preceded by the KP tones, and followed by the ST tones. The LA tandem office decodes the tones and, in this case, connects you to the CO serving the party you dialed. The CO now decodes the last four digits of the number, connects you to the proper line, and starts ringing it.

When the other party answers, the ringing stops and a signal is sent all the way back to your CO to indicate that the call has reached its destination. This too is punched into the CAMA paper tape.

If you hang up first, your CO of course knows this immediately. On the other hand, if the party hangs up first, a signal has to be sent back to your CO. The L.A. CO notifies the L.A. tandem, the L.A. tandem puts 2600 Hz back on the line to signify a disconnect, the New York tandem gets the tone and breaks the connection, and notifies your CO. If you listen carefully, you may hear a short burst of 2600 Hz just before the connection is broken at your end.

At this point your CO again punches your number, the time and the number you dialed

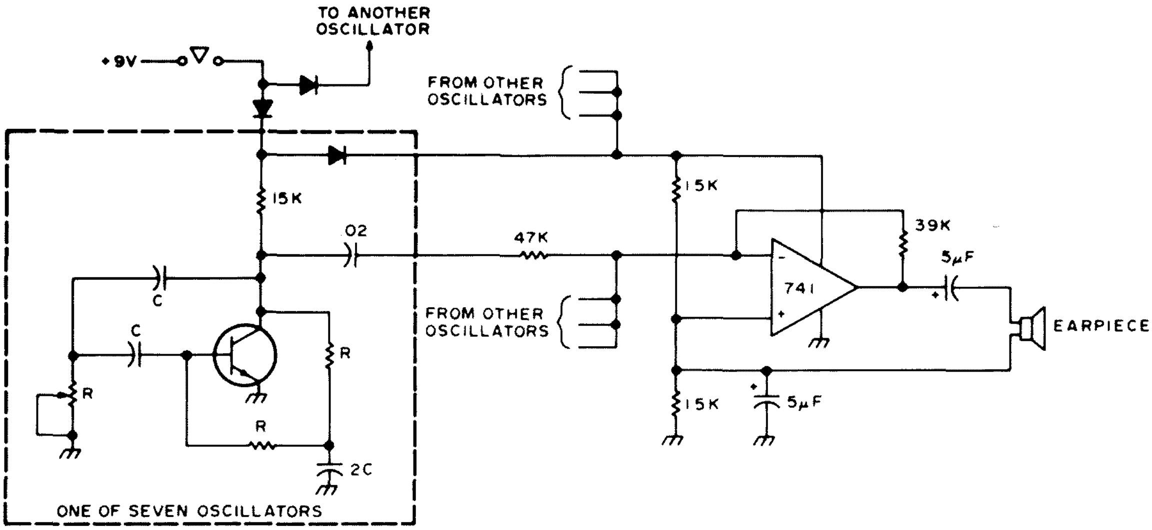


Fig. 15. Early version of the Blue Box, circa 1972. Seven identical oscillators are needed.

into paper tape. Once a day this tape is sent to the computer, which then reads the tape and eventually uses it to prepare the bill.

The CAMA tape runs on every call, even calls on which there is no answer, or which are free (such as information calls or calls to area code 800). It's up to the computer to decide at the end of the month what to bill and how much. This, by the way, is one way to detect black, blue and red boxes since a record is kept of all calls and the computer can be programmed to look for any suspicious calls.

Now, where does the Blue Box fit into the story? The Blue Box is just a box with thirteen buttons and the oscillators to generate the MF tones – 0 through 9, KP, ST and 2600 Hz disconnect. These tones are acoustically coupled from the Blue Box into the mike of the phone. With it the phone phreak can use the toll circuits to place calls anywhere in the world without charge. With enough knowledge of the system he can route himself via a specific path and can even choose whether he will go via cable or satellite. Some phone phreaks delight in sitting in a phone booth and routing a call to the very next booth all the way around the whole globe; then they talk to themselves and enjoy the fact that their voice is delayed by having to travel all the way around the world.

The procedure for using the Blue Box is simple. You start by placing a long distance call in the normal way either to a free number (information or a valid 800 series number) or else to a close-by destination which is cheap to call. This is the call which will appear on the CAMA tape. Since a long call to information or to a non-existent number is suspicious, dedicated phone phreaks usually make sure to use a valid 800 number or, if not too stingy (or stubborn), even a paid call to a nearby place.

Once dialing is completed, your nearby tandem routes the call to the tandem office at the destination, possibly through intermediate tandems along the way. As soon as you hear ringing from the other end, you feed 2600 Hz into your phone for one second.

Your local CO is unaccustomed to getting 2600 Hz and so simply ignores it, but passes it on to the nearby tandem.

This tandem can recognize 2600 Hz as a disconnect idle from other tandems, but is not built to react to the signal coming from a CO. So it ignores it and passes it on. But the *next* tandem, thinking you hung up, cancels the call. This leaves you hanging, still connected to a toll line between tandems. After one second of 2600 Hz, you remove it. The distant tandem now sees that the line is no longer idle, and so it connects an incoming sender. As soon as you hear the click signifying this, you have ten seconds to dial the desired number, preceded by KP and followed by ST. For example, to call (603) 924-3873 you would press KP6039243873ST.

When the number answers, a signal is sent back and the CAMA tape punched to indi-

cate the connection time. At the end of the call, the CAMA tape is again punched with your number, the time and the number you originally dialed. This is the call and time for which you will be billed (unless it is free) and the number actually reached with the Blue Box is not recorded.

Since all calls are punched into the CAMA tape, even the most daring phone phreakers would use a pay phone rather than their home phone. Moreover, since the mere possession of a Blue Box might be considered suspicious, some record the tones on a cassette and then erase it as soon as possible. The actual Blue Box circuitry is interesting not only for the insight into the technical competence of the phone phreaks, but also because with just a retuning, it can be used for Touchtone generation.

Fig. 15 shows an early version of a Blue Box, where each tone is generated by a separate one-transistor oscillator. There would be a total of 7 oscillators and 13 push-buttons, with each push-button (except the 2600 Hz disconnect/idle button) feeding two oscillators, through a diode.

The Twin-Tee oscillators generate a relatively clean sine wave, but some juggling of values is needed. The oscillation frequency is

$$f = \frac{1}{2\pi RC}$$

where the best values for R are between about 30k and 100k. In all of these circuits, see Fig. 15 for component data. Since disk capacitors are very unstable with temperature, frequency-determining capacitors should be good quality mylar or preferably polystyrene.

Fig. 16 shows a later version of the Blue Box, showing real state-of-the-art design with all ICs. The LM100 (or LM300) regulator is needed to assure stable frequency characteristics – my own preference is a 723, which uses a similar circuit, and is easier to get.

The use of the Intersil 8038CC shows a good knowledge of the field by whoever designed this circuit in late '73 or early '74. The uninitiated wouldn't know about this new ultra-stable IC which, unlike the 566 or other popular oscillator ICs, generates a very low-distortion sine wave. Only two oscillators are needed, as the switches and diodes select different pots for different tones. Although most Blue Boxes seem to use plain push-buttons, Chomerics makes nice switches which are suitable.

Just to give you an idea of the power of the Blue Box, here are some numbers and destinations that have been published in various places:

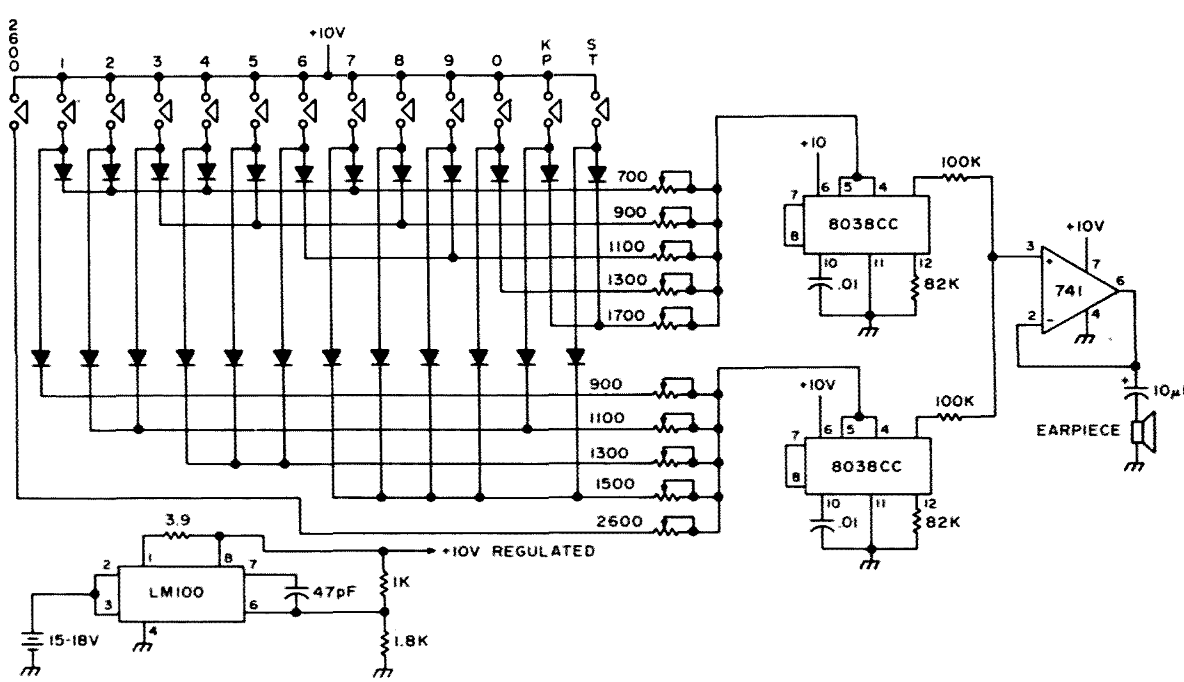


Fig. 16. Later version of the Blue Box, circa 1974. The pots are 25k; .01 uF capacitors are mylar or polystyrene.

London weather: KP 044 1 246 8091 ST
Sidney, Australia weather: KP 061 3 6064 ST
Sidney time: KP 061 2 2074 ST

The digits 044 or 061 in the above numbers are the country codes agreed on by the CCITT; further information on country codes, Blue Box tone frequencies, etc., is published in Chapter 2 of *Reference Data for Radio Engineers* (Howard W. Sams) as well as in an underground (and sometimes nasty and violent) newsletter called TAP ($2 for a one-year subscription from TAP, Room 504, 152 West 42 Street, New York NY 10036).

Further information may be obtained from a book entitled *Basic Telephone Switching Systems* by David Talley (Hayden Book Company), *Communications System Engineering Handbook* edited by D. Hamsher (McGraw-Hill Book Company) and various telephone company periodicals. *The Bell System Technical Journal* should be available in most engineering college libraries, and carries a lot of abstract and mathematical articles as well as some fairly practical descriptions. For example, the November 1960 issue has an article on "Signaling Systems for Control of Telephone Switching." A much more readable publication is the *GTE Lenkurt Demodulator* (GTE Lenkurt, 1105 Country Road, San Carlos CA 94070) which is a monthly magazine available free to people working in the communications field or in schools.

The GTE equivalent of the Bell Systems Practices is called the General System Practices, and may just possibly be available locally or from GTE Automatic Electric Inc., Northlake, Illinois. You may also be able to get your hands on a mail-order course offered some years ago by Don Britton Enterprises in Hawaii. A new book, *How to Cut Costs and Improve Service of Your Telephone, Telex, TWX and Other Telecommunications* by Frank Griesinger (McGraw-Hill) and a monthly magazine called "Communications News" are other possible sources.

In closing, I would again like to caution readers that the telephone companies do their best to "discourage" the use of the various colored boxes described in this article; the information presented here has been written only for your own information and entertainment, not as a guide for construction or use.

(AUTHOR'S NOTE: Some time after this article was written, AT&T, in response to a complaint lodged with the FCC by Phone-Mate Corp., a large manufacturer of telephone answering machines, made a concession in its insistence on the use of a coupler with an answering machine. It applies *only* to telephone answering machines though. For a fee, the Bell System will license the answering machine manufacturer to build and install a coupler directly into the answering machine, using a design developed by Bell System engineers. The coupler consists of several transistors, resistors and capacitors, limiting diodes, a relay, and a three-winding transformer, and is estimated to cost less than $20 to build. It is basically a receive-only coupler which prevents the answering machine from dialing outgoing calls. Although further details haven't been released at the time of writing, it doesn't look as though the answering machine manufacturers will be making these couplers separately for updating older machines, and there seem to be quite a few strings attached.)

(SECOND AUTHOR'S NOTE: Gradually, more details are coming out about the strings attached to the coupler offer to answering machine manufacturers. AT&T will consider only inquiries from actual manufacturers, who must submit a $1000 non-refundable "inspection fee," for which AT&T will send a team to inspect the manufacturer's factory to determine whether he is "qualified" to manufacture the coupler. Only if he passes, will AT&T discuss the price with him, apparently on a take-it-or-leave-it basis. The coupler design appears to be more complicated than was announced originally, and includes an opto-electronic coupler – neon bulb/photocell combination – to detect ringing, similar to the circuit on page 31 of the April 1974 issue of 73 Magazine. Only time will tell how many answering machine manufacturers will decide to gamble the $1000 on such a basis.)

. . . WHIPPLE

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Dirt Cheap Tunable I-F for Converters

Having a 6 meter Tunaverter and having tried it with various small transistor radios, I thought there had to be something better. I began to look for a used solid state auto radio that was small and cheap! I was lucky – I found two that were made for foreign cars (one was a Motorola and the other was a Peptone, which I understand Volkswagen uses) and they cost $6 for the two. One had a broken plastic dial shaft (which epoxy cured) and the other was just dirty.

I saw a picture of a set-up where a ham mounted a car radio and converter in a cabinet, making a VHF solid state radio, but he was using it as it was. I chose the Motorola to change. Be sure to check out your radio before any changes and make repairs if needed. As is, they are much too hard on batteries (even small cads, where you have a transistor transmitter and modulator working from the same supply); the power stage alone, according to service records, draws 350 mA. Still want to buy dry batteries?

I took the cheap way out. I had a partly stripped AM/FM radio and I took a hacksaw and cut the push-pull audio section out, repaired the broken (sawed) connections, soldered leads to it and mounted it in the radio where the original output transformer had been located. Mine had a positive ground, so I had to insulate it from the chassis by fiber washers.

The emitter's resistor was originally 2Ω, but the transistors heated up using 12 volts, so I broke the lead and added a 1/2W 5Ω resistor and all was well. My heatsinks (until I can get some to fit TO-1 case) are short lengths of sawed off acid brush, with silicon grease. Plain old iron!

Fig. 1 shows the original circuit of the car radio and Fig. 2 shows what I used. When you remove the input, output transformers, the power transistor and the resistors and bias pot associated with it, make a diagram and put it with the parts, as you may want to make a 12 volt one or two watt amplifier someday and you have already got all the output section.

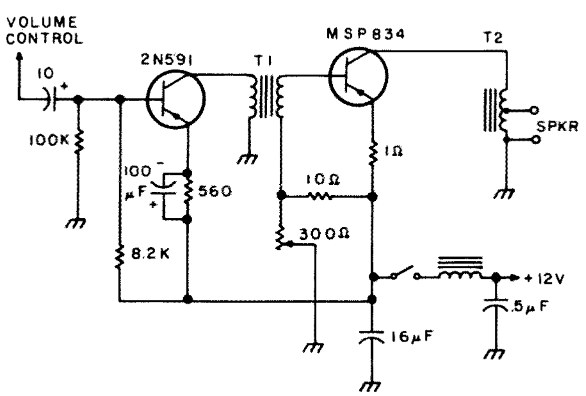

Fig. 1. Basic audio before change.

Fig. 3 shows an output you may use (from GE Transistor Manual). You can use RCA SK3004s or any transistor that they replace (see SK sub-booklet from any RCA dealer), as there are many, many types. Notice that the SK3005 is for 9 volt service while the SK3004 is used up to 15 volts. The booklet should be in every ham shack anyway!

If you use the power stage from a 9 volt radio, be sure to heat sink the transistors

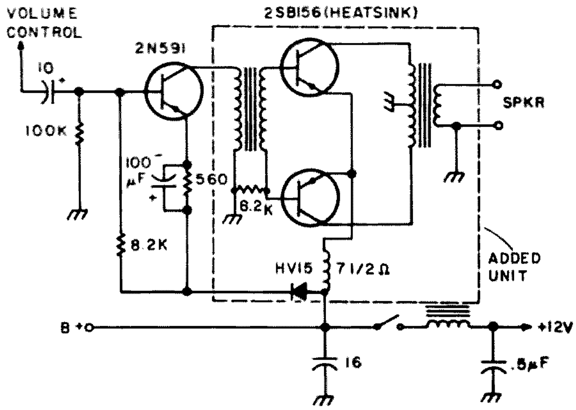

Fig. 2. Audio used in radio after change.

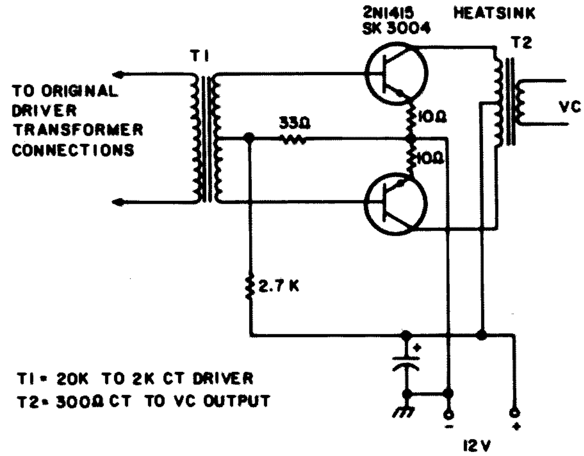

Fig. 3.

and raise the emitter resistor value at least two times.

Results

The auto radio is well shielded and *does not* have the pickup of BC stations an unshielded loop antenna radio has. That is a big improvement. No. 2 is that the auto radio has a tuned rf stage ahead of the mixer, better agc action and no pulling of the oscillator when a strong signal is received.

Another big improvement is battery saving. Remember that old power stage took 350 mA alone!

With the set on and volume turned up loud enough to hear and with a 100 mA meter in the supply lead, the meter reads 20 mA. This is with the volume control set so the class B stage makes little noticeable flickers (loud enough to hear signals well). With normal room volume the meter swings up to 40 mA and at full volume the meter kicks to 45 mA.

Tunaverter makes 6, 2, SW, police and CB converters (tunable and crystal controlled) which are a natural for this set-up as they use a 1500 kHz i-f. I have this set-up for 6. Now I am 100% solid state.

This is also a natural for those of you who want to home brew a converter from SW ham bands to VHF. You could never build a radio cheaper that equals this.

Remember while using a converter that you have a double conversion receiver. The first i-f is at 1500 kHz (or any frequency you choose in the BC band) and a second i-f of 262 kHz. You may want an S-meter. I have not tried that yet. I may try an expanded milliammeter using a zener diode so the meter won't read transistor current (rf or i-f or both stages) without a signal, but most likely will build a small transistor version of a VTVM and connect it to the agc or output of the diode detector, whichever works best. Any meter connected to circuits would load too much, although you might try to take a 0–50 μA meter and with 100,000Ω resistor (makes a 0–5 volt meter) connect it to the diode detector. This value won't load the 5–25K diode circuit very much.

I disconnected the pilot light to save a few hundred miles of battery power.

If you can, get a diagram of your radio. If you go my route, most transistor radios (older ones anyway) use a positive ground, so the power unit will have to be insulated from the chassis. Check this over and plan before you start cutting. It can save you a lot of grief later.

Some radios may have a feedback loop from one side of voice coil winding back to the emitter of the driver (or somewhere in the first audio section). If you connect this up to the "new" output and get a howl, don't panic, just solder that voice coil lead to ground and lift the other from ground and connect the feedback loop to this (merely reversing voice coil leads and reversing phase 180 degrees). The feedback loop is sort of a bass boost and is desirable if you have it.

Since the Tunaverters' older line is selling cheaply, I plan to have six, two, police and WWV, with a band switch to switch in the converters and power. As portable, I intend to use a nicad battery, and at home base use a well regulated power supply. . . .**KØVQY**

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6m IC Rx

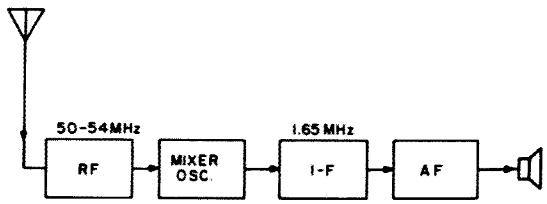

Fig. 1. Block Diagram.

This article describes design methods and a working breadboard example of a foundation receiver for 6 meters using ICs for the rf, i-f and af, and tuning from 50 to 54 MHz. The rf, i-f and af are in individual sections and many things can be learned about VHF receivers by working with this concept, starting with single conversion.

Front-end sensitivity, noise and stability, suitable ICs, i-f selectivity, gain and avc, are among the parameters that can be adjusted separately in this basic receiver. It is an interesting low cost piece of equipment to have around for monitoring 6 meters in your area, checking crystals, etc.

Fig. 1, the block diagram, shows the concept of separating the three different ICs, which allows testing and comparison of various kinds of ICs. This can be important today, especially in the rf and i-f range where those tiny little integrated circuits become more fussy frequency-wise than when used in computers.

The rf section, shown in Fig. 2, uses the Motorola HEP 590, an IC which has interesting parameters against which other ICs and transistor stages can be compared. The main features of the HEP 590 are some 30 dB of gain and no self-oscillation.

Where tunable peaking is used as in this basic circuit, there is one trouble you could encounter. Putting the input and output tuning capacitors C1 and C2 on the same

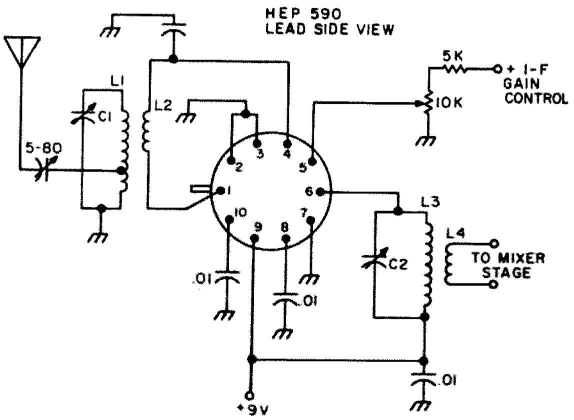

Fig. 2. Rf stage. L1, L3 – 6 turns airwound, 8 turns per inch, ½ inch diameter. L2 – 2 turns wound on L1. L4 – 3 turns wound on L3. C1, C2 – see text.

small metal front panel produced a feedback path which caused rf oscillation. Just keep those grounds somewhat apart and you'll be alright.

With 75 pF for C1 and C2 this unit is an excellent preamp for 6 and 10 meters, and (although I don't like to say it) for CB also.

The mixer and oscillator are shown in Fig. 3, are sure fire, and have all the bugs worked out of them. The oscillator is link-coupled to the mixer and is thus very easy to change over to crystal control if you want to make a fixed-tuned front end converter out of it later. The coupling between the rf and mixer stages can be adjusted for bandpass by

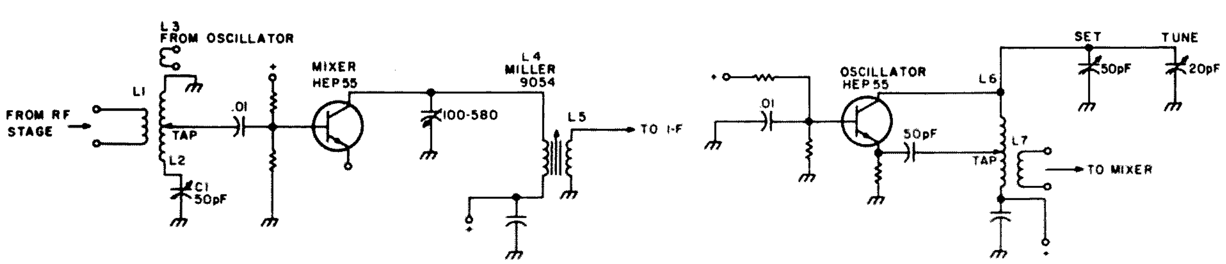

Fig. 3. L1 – 2 turns on L2. L2 – 6 turns airwound, 8 turns per inch, tapped at 2 turns. L3 – 2 turns on L2. L4 – Miller 9054. L5 – 2 turns on L3. L6 – 7 turns ¼ inch diameter, ½ inch long tapped 1 turn from cold end. L7 – 2 turns on cold end of L6.

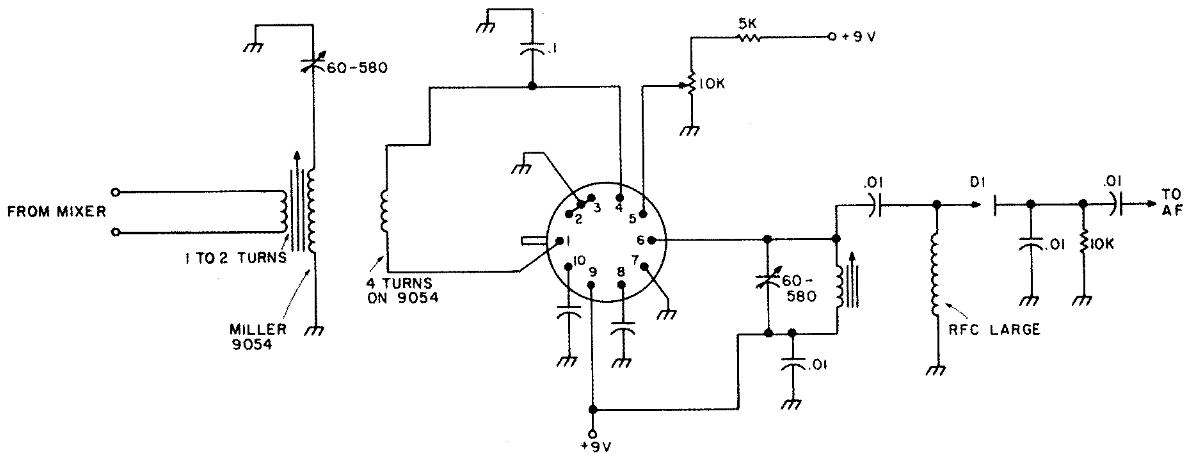

Fig. 4. I-f stage, 1.65 MHz.

the use of more or fewer turns on L1. The mixer base tap on L2 is also useful in controlling the rf selectivity.

L3 is tuned to the i-f frequency of 1.65 MHz and goes out on a cable to the i-f section.

The i-f also uses a Motorola HEP 590 IC and is quite similar to the rf stage but tuned to 1.65 MHz. Fig. 4 shows the details, with Miller 9054 ½ inch slug-tuned, electrostatically and magnetically shielded coils for the i-f transformers. The gain control can be used or not as desired. For more selectivity or a check on filters, use another i-f stage like this one, with a filter in between, as shown in Fig. 5. This filter is very interesting because of its low-cost, ease of construction and adjustment, and what it can do for you. By keeping L1 and L4 small, such as one turn only, peaking up L2 and L3, and reducing C3, a high degree of selectivity can be obtained considering the low cost and simplicity of single conversion. I have used this filter design from 10.7 MHz to 135 kHz and it really works. You can also put more than two sections into it, but do not use too many in series without an amplifier stage, as there is some attenuation through each one.

The demodulator uses the power circuit which I have found excellent at all i-f frequencies. The diode is connected to the high end of the i-f output transformer. There is a slight loss in selectivity which can be made up anywhere in front, but the af seems to always have more punch with this detector circuit.

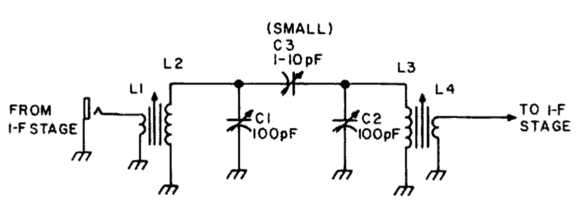

Fig. 5. I-f filter, 1.65 MHz. L1 – 1 or 2 turns. L2 – Miller 9054. L3 – Miller 9054. L4 – 1 or 2 turns.

The Amperex TAA-300 is *it* for the audio section. A single ten pin transistor can, a few bypass capacitors, a gain control, an 8 Ohm speaker and there you are with up to one watt out and flat response from 25 to 25,000 Hz at 1 dB. Need I say more? Fig. 6 shows the external connections to be used. I checked the details for bypass capacitor values that can be used for voice frequencies and these are the lower values in the schematic. The higher values are the recommended ones for a miniature hi-fi set, which it then really is.

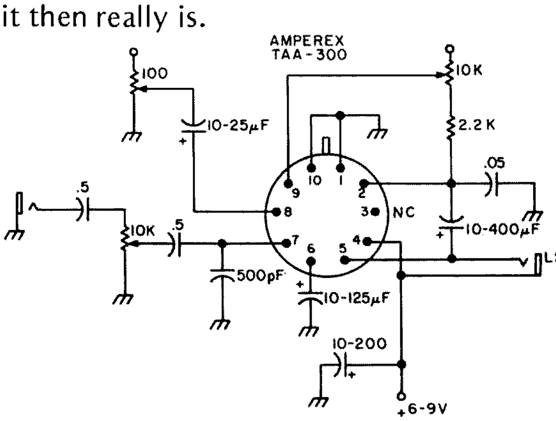

Fig. 6. Af IC.

Once again, this is really a foundation design, for seeing what's on the air on 6 around your area, and with the plug-in cable-connected sections, allows you to test out all kinds of components for rf and i-f, transistors, ICs and all.

. . . K1CLL

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All Band Frequency Marker

A Simple C/MOS Marker Generator

Crystal controlled marker generators are useful adjuncts in any frequency determining situation requiring high accuracy, such as locating band edges, sub-bands and calibrating receivers. If you've been entertaining thoughts about construction of one, a version is described here which uses the new C/MOS integrated circuits powered by a 9 volt transistor radio battery. And instead of the usual rotary harmonic selector switch, a multi-pin IC connector strip and three test plugs serve as a miniature patch panel to enable various divisions of the reference crystal, with a maximum countdown of 256. "Rocks" from 100 kHz to 4 MHz oscillate readily in this circuit. In this model an FT241 xtal set to 400,000 Hz has been chosen for control and has usable receiver calibration divisions down to 2.5 kHz. The harmonic spectrum extends to at least 160 MHz, the tuning limit of a transistor superregen used in testing. When used in densely

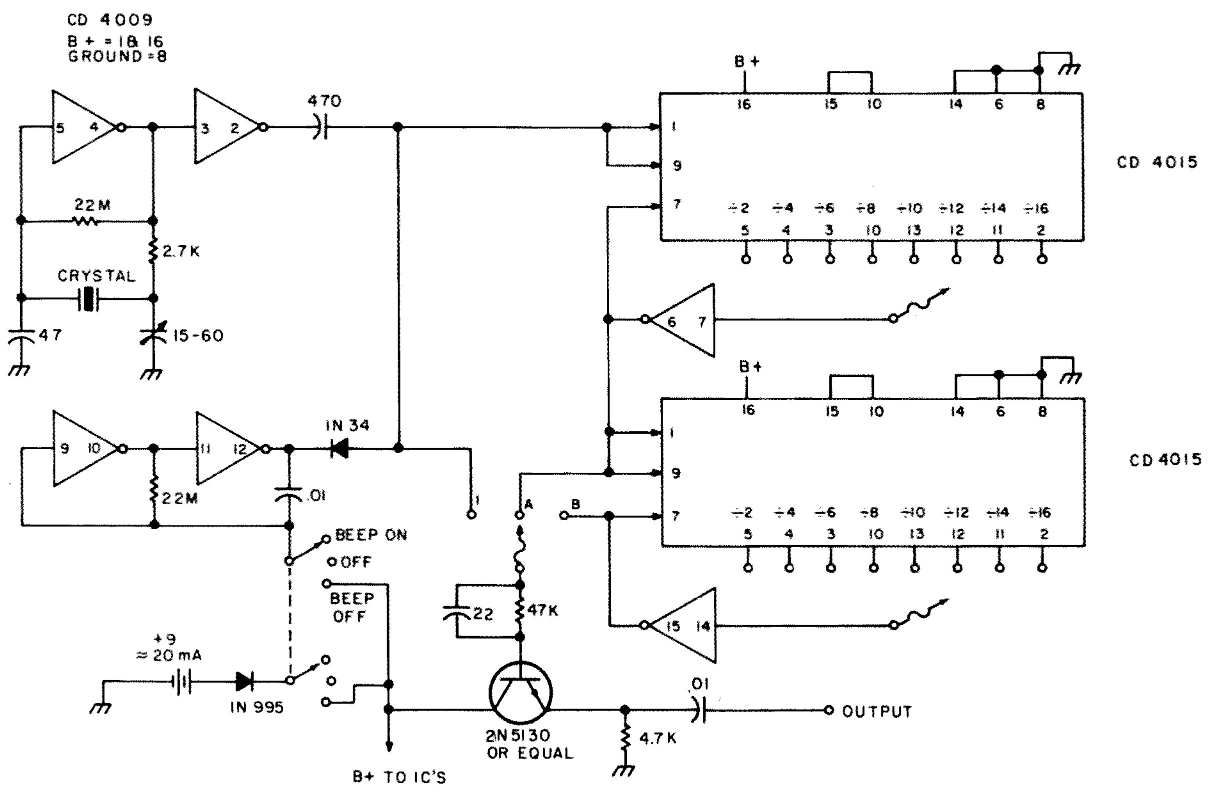

Fig. 1. Schematic.

Divide by	Output, kHz
1	400
2	200
4	100
8	50
10	40
16	25
20	20
40	10
80	5
100	4
160	2.5

Table 1.

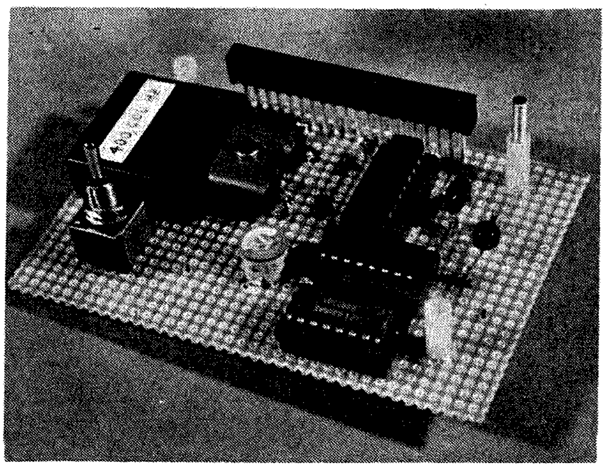

Photo 1.

occupied HF bands, an AM beeper can be switched on as an identification aid.

Referring to Fig. 1, one third of a hex inverter makes up a crystal controlled oscillator and buffer, another third is a slow rate pulser and the two remaining units function in the dividing section. These are all standard circuits described in RCA's COS/MOS Data Book #SSD-203. An emitter follower minimizes loading on the IC outputs, speeds up rise time to increase harmonic content, and provides a low impedance output. The AM beeper is a simple clamp that gates rf on or off to following stages.

Photo 1 shows all components mounted on Vector P pattern perf-board that fits inside a Bud minibox. Sleeving 3/8" (10mm) long is slipped over the wire trap terminals of the contact strip to space it up from the board. A DPDT center-off miniature toggle switch acts as one board to panel spacer. Diagonally across from it, a 4-40 threaded rod conducts emitter follower output up through the front panel via a 1/2" (13mm) insulating spacer and plastic shoulder washers. Two regular 4-40 screws and spacers complete the four corner mounting. This spacing allows the contact strip to project partly through a panel cutout so that it is mechanically secure without fastening.

Photo 2 (completed assembly) shows a stick-on label with patching connection callouts for various division ratios. If only one crystal is employed, labeling could indicate most used frequencies instead. A typical frequency vs division listing for this model is shown in Table 1. You can easily make up a complete table of all possible ratios, remembering that each CD4015 shift register divides by even numbers ONLY, starting at 2 and ending at 16.

Uses to which a marker generator may be put have been described before: i-f alignment, BFO, scope linearity, etc. A type that divides down to the audio range like this one is especially useful in checking superhets. A

1	CD4009	1	15/60pF trimmer
2	CD4015	1	.01 uF
1	1N34	1	xtal; see text
1	1N995	1	xtal socket
1	2N5130 or equiv.	1	Alco #MST205P switch
1	2.7k	1	Bud #CU-2115HG minibox
1	4.7k	1	Vector #44P29-062 perfboard
1	47k	1	#216 battery
2	22M	1	Battery connector
1	22pF	3	16 pin IC sockets
1	47pF	3	Augat patch pins or equiv.
1	100pF	1	20 pin contact strip SAE #Series 7000
1	470pF		

Table 2. Parts List.

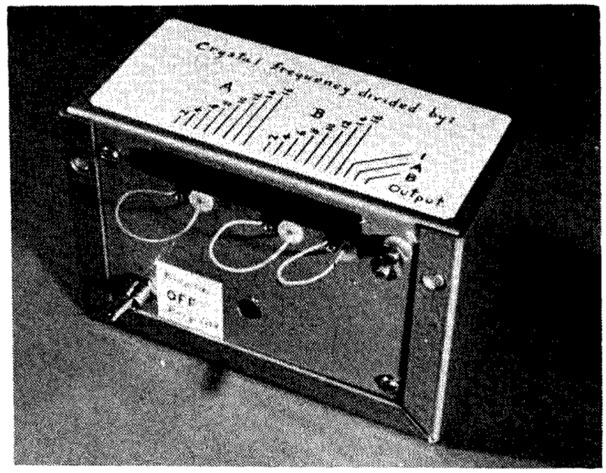

Photo 2.

very broad and flat spectrum of overlapping signals is generated and an audio tone will be heard no matter where the set is tuned. If its tracking and sensitivity are top-notch, the S meter will hold steady over the tuning range. Tracking adjustment amounts to tweaking for maximum meter reading or loudest audio tone. Then patch for 100 KHz markers and check calibration. It's a lot faster and easier than using a conventional signal generator.
. . . W1KNI

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Protect your Gear with a Latching Relay

In a wide variety of commercial and amateur amplifier and oscillator circuits, failure of the excitation causes failure of the bias, so that plate and screen currents rise to dangerous levels. If either the excitation is not promptly restored, or the power cut off, one or more tubes, and sometimes the power supply, will be damaged or destroyed.

To protect the circuitry from the results of excitation failure, a wide variety of protective circuits, ranging from a fuse to a contacting milliammeter with a back-up relay, have been devised. Most common protective circuits consist of a current-operated relay of some sort, usually in conjunction with a fixed protective bias. Many of the proposed protective circuits work, and some of them work well.

Not commonly used in either amateur or commercial equipment, but most effective for shutting off the power when the current drain soars, are circuits incorporating a latching relay. With these, a sharply rising current shuts the equipment off, and it stays off until power is restored manually, hopefully after the cause of the trouble has been located and removed.

Symmetrical Latching Relays

The symmetrical latching relay normally consists of two relays, mechanically and electrically similar, mounted on the same base, and mechanically interlocked, so that either one can be operated by a short power pulse, and latches in actuated position, drawing no more power until a change of state is desired.

The appearance of a commercially-made symmetrical latching relay is shown in photo. The specific relay shown is a Potter and Brumfield type KB 17 AY, with 115 volt ac coils. The mechanical latching mechanism is visible in center of this view. Here, the armature of relay A is down and latched, that of coil B is up and unlatched.

Happily for our purposes, change of state of a symmetrical latching relay is not instantaneous. If the armature controlled by coil A is down and latched, it will remain so after energization of coil B until the armature of coil B is firmly seated. In consequence, dependable operation of both relays is

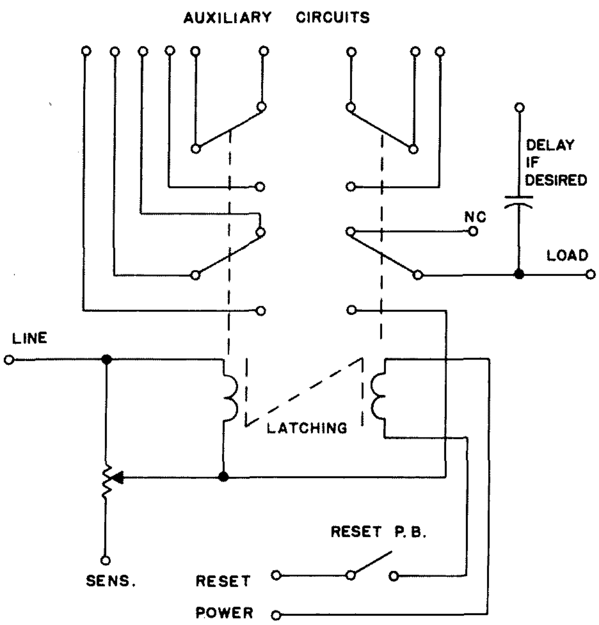
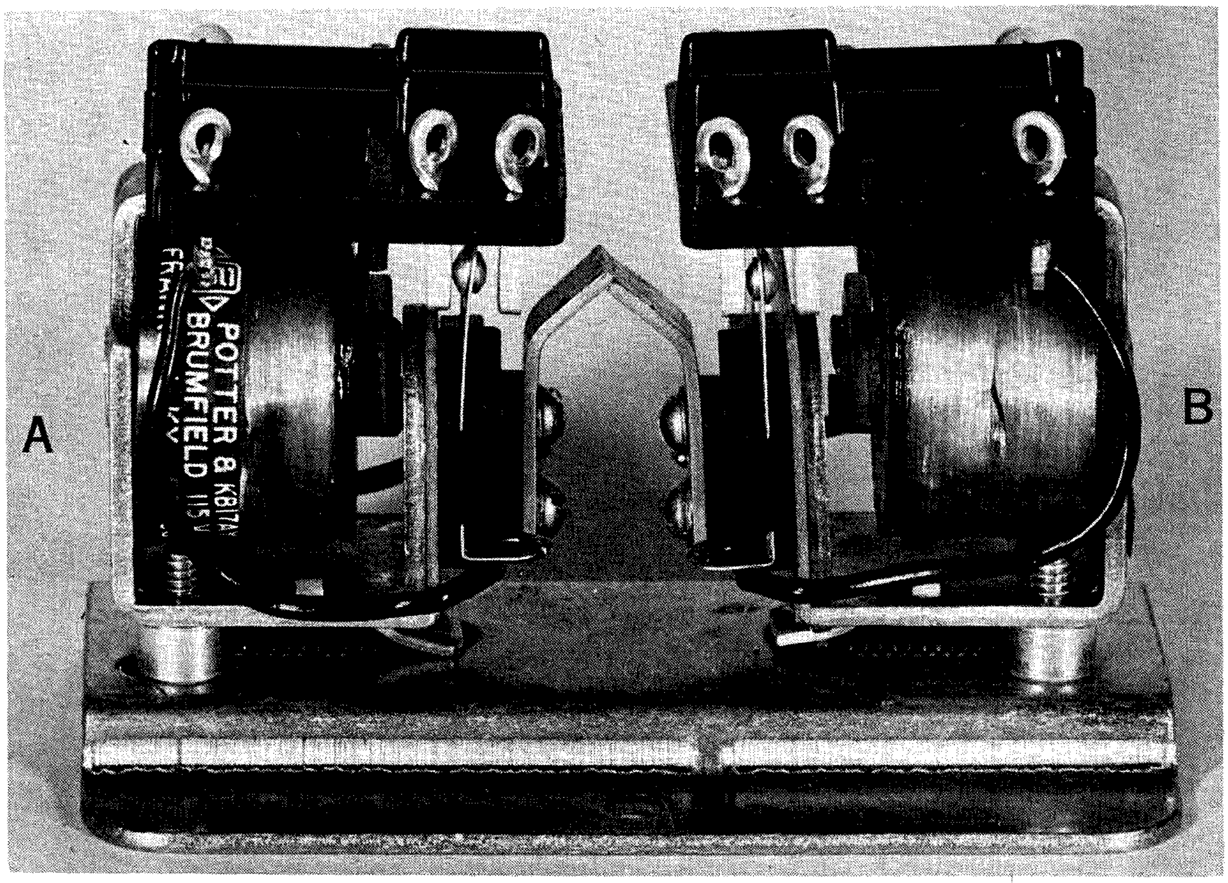


Fig. 1. Typical overcurrent relay circuit.



Typical symmetrical latching relay.

possible with the coil of each in series with the contacts of the opposite relay.

Overcurrent Circuit

For overcurrent protection, one coil of the latching relay is connected in series with the load, as in Fig. 1. The other coil is connected in series with a push-button and a suitable power source to act as a reset. Contacts of this second coil (B) are in series with the first coil and the load.

When the armature of coil B is down and latched, load current flows through coil A. When current in coil A exceeds the operating current, the armature pulls down, releasing armature B, and opening the load circuit. No further current reaches the load until the system is reset, and it will not stay reset if

Nominal coil volts (a)	Coil resistance in Ohms	Nominal current in mA (b)	Relay type (P and B)
110 D.C.	4560	24	KB-17-D
110 A.C. (72)	1030	70	KB-17-AY
24 D.C.	230	104	KB-17-D
12 D.C.	52	230	KB-17-D
24 A.C. (11)	42	265	KB-17-AY
6 D.C.	13.1	460	KB-17-D
12 A.C. (7.1)	10	710	KB-17-AY
6 A.C. (3.4)	2.3	1500	KB-17-AY

(a) Figure in parentheses is D.C. voltage computed from volt-ampere rating of coil.
(b) When operated on D.C.

TABLE 1.

load current exceeds the operating current of coil A.

The rheostat shunted across coil A is a sensitivity adjustment, to set the pull-in point of the relay at the exact current desired. The system can be made insensitive to short-term current surges by shunting a fairly large capacitor (10μf or more) across the load. This will also improve system regulation, reduce ripple, and may raise the output voltage a trifle.

Available Equipment

The relay chosen for an overload protection function depends primarily on the current normally drawn by the load. Knowing this requirement, we can pick the most suitable relay from the available equipment, making minor adjustments in sensitivity with the shunt rheostat.

Characteristics of stock latching relays, based on Potter and Brumfield catalog data (mechanically and electrically similar relays, at similar prices, are made by Globe, Magnecraft, Line, Ohmite, Phillips-Advance, and Schrack, among others), have considerable excess sensitivity, so they operate at lower current than indicated by the table. Most dc relays pull in at from .5 to .65 of computed current: most ac relays pull in at from .3 to .5 of computed current, but operate more slowly than dc relays due to the shading ring.

All of these relays will stand either 110V or twice the rated voltage (whichever is greater) to ground indefinitely (years). Several 110V dc relays in this group, used as plate relays, have withstood 500V to ground for long periods, but this is not a recommended practice. A little added insulation is very much cheaper than a replacement relay.

Dependability And Consistency

The symmetrical latching relay has been with us for quite a few years. Many from the first production runs are still in service. The life of a symmetrical latching relay exceeds one million operations in normal industrial service, with only nominal maintenance, like blowing the dust and dead insects out periodically, and cleaning the contacts (not filing them) every six months or so.

Tests with a number of stock relays indicate that their performance is consistent within better than five percent over a period of months, with a slow drift to sluggishness with time and accumulations of gummy dirt (removable with carbon tetrachloride – ventilate well). In consequence, for overcurrent detection, when the current overage is catastrophic (many times normal), these relays are ideally suited. They should not, however, be used in close differential service in the circuit shown.

Auxiliary Circuits

Symmetrical latching relays are normally supplied in four pole and six pole double throw. Only one pole is needed for overcurrent protection, leaving either three or five poles available for auxiliary functions. One pole double throw is usually adequate for idiot lights; the others can be used for anything desired.

. . . IVES

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A Case for CW

Ever since I can remember, my impression of an Amateur Radio Station was one where the operator was wearing headphones and sending with a hand key. The idea that he would use, or even own, a microphone never crossed my mind. Radio communication seemed synonymous with CW; there was no other way. It still seems that way to me.

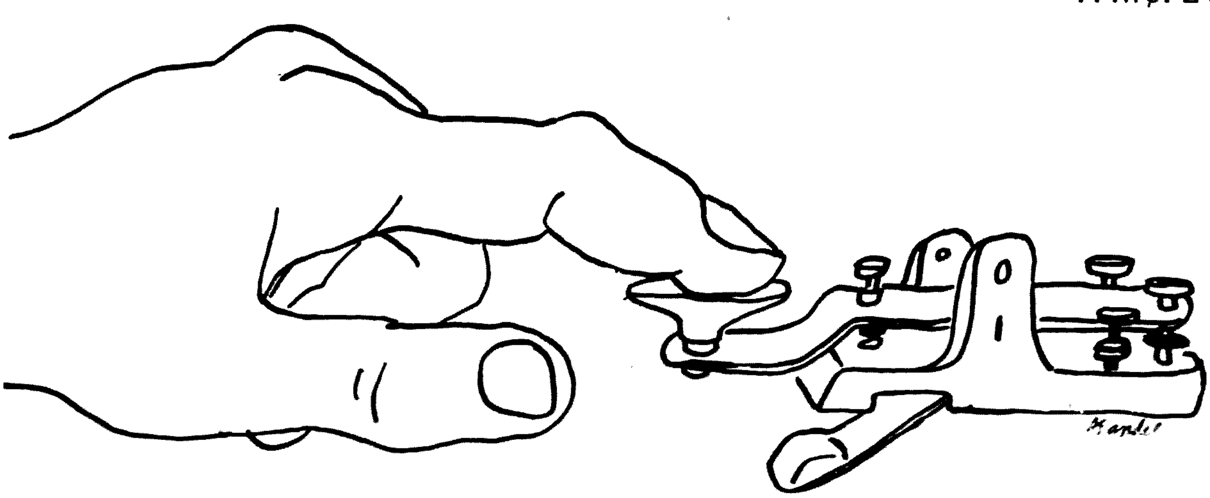
To most hams, CW is looked on as a thing of horror, an annoying source of interference, that hopefully someday will go away. They wonder why anyone in his right mind would ever consider it as a means of communication. They think that if the Good Lord in His infinite wisdom wanted us to communicate that way, He would have provided us with a built-in 400 Hertz filter. To this "unenlightened" group, this article is respectfully dedicated.

I suppose there are as many valid reasons for not using CW as there are for using it, most of them technical (which won't be repeated). Instead, I offer two additional reasons.

CW, like tennis, bowling, chess, "The Game", or whatever, is a skill that must first be learned then developed. The degree of this development is directly related to the effort expended. Likewise, the degree of enjoyment obtained is related to the proficiency attained. To those in our fraternity who pursue a sport or other endeavor simply for the joy of conquering a new "field", or to excel in an existing one, I submit CW as worthy challenge.

There is yet another area of appeal which may not be appreciated by most. CW is an excellent means of "escape". What better way is there to set aside your problems of the day and enter into another world – one that completely absorbs your full consciousness – than to get on CW? All you need to "enter" is a little knowledge, lots of patience and some basic skill; the rewards can be very gratifying. To the old timers who regularly operate in this mode, I can only say "You know what I mean". To the outsiders I say, "Try it, you'll like it."

...WØFEV



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ID Timer

For about \$6.00[1] this project can be many things to many people. This ten minute station timer utilizes a digital readout display indicating elapsed time in minutes. When nine minutes has passed, the 9 numeral blinks for 60 seconds, which is a real eye catcher, before resetting to zero, starting another count cycle. A manual zero reset is provided to start the timer at the beginning of your QSO.

If you have not, as yet, "gotten your feet wet" with relaxation oscillators, ICs, or numeric display tubes, this is a simple starter project.

Circuit

The timer is line operated, and all circuitry should be isolated from the exterior cabinet. Line voltage is divided to supply 10 volts to the bridge rectifier. This voltage is dropped and regulated to 5 volts for the unijunction pulse generator and ICs. Adjustment of the 1 meg pulse generator pot determines the time necessary to charge the 100 μF timing capacitor, which should be of good quality. When this capacitor charges sufficiently to turn on the unijunction, the transistor fires, discharging the capacitor and generating a voltage pulse across its 47Ω resistor. These pulses are counted by the 7490 decade IC. The output of the counter is fed to the 7441 decoder driver which turns on the proper numeral in the readout tube.

The 9 numeral is connected as a relaxation oscillator and flashes. The flash rate may be varied by changing the value of the 100k resistor. The 3 μF capacitor must be paper, not electrolytic. Approximately 140 V dc for the readout is obtained from the line via a single diode and filter.

Reset

Depressing the manual reset button lifts the 7490 terminals 2 and 3 off ground, resetting the count to "0." At the same time, the 100 μF capacitor is shunted to ground through four diodes, which discharges it to approximately the same level as does the transistor. This eliminates an extra long first count after a manual reset.

If you have not done so before, the action of all functions of this circuit may be observed with a scope or VTVM.

This circuit, of course, may be used for other timing functions by changing the value of the unijunction timing components.

Accuracy on several units built was within 15 seconds over any ten minute period.

...WB4MYL

[1] Poly Paks. Some surplus 7441 ICs were found to generate wide band noise on some or all digits (455 kHz – 180 MHz). This, of course, is not tolerable and will not be observed on a 100% good 7441. Radio Shack's pre-etched board, "One Digit Counter," may also be used for this project.

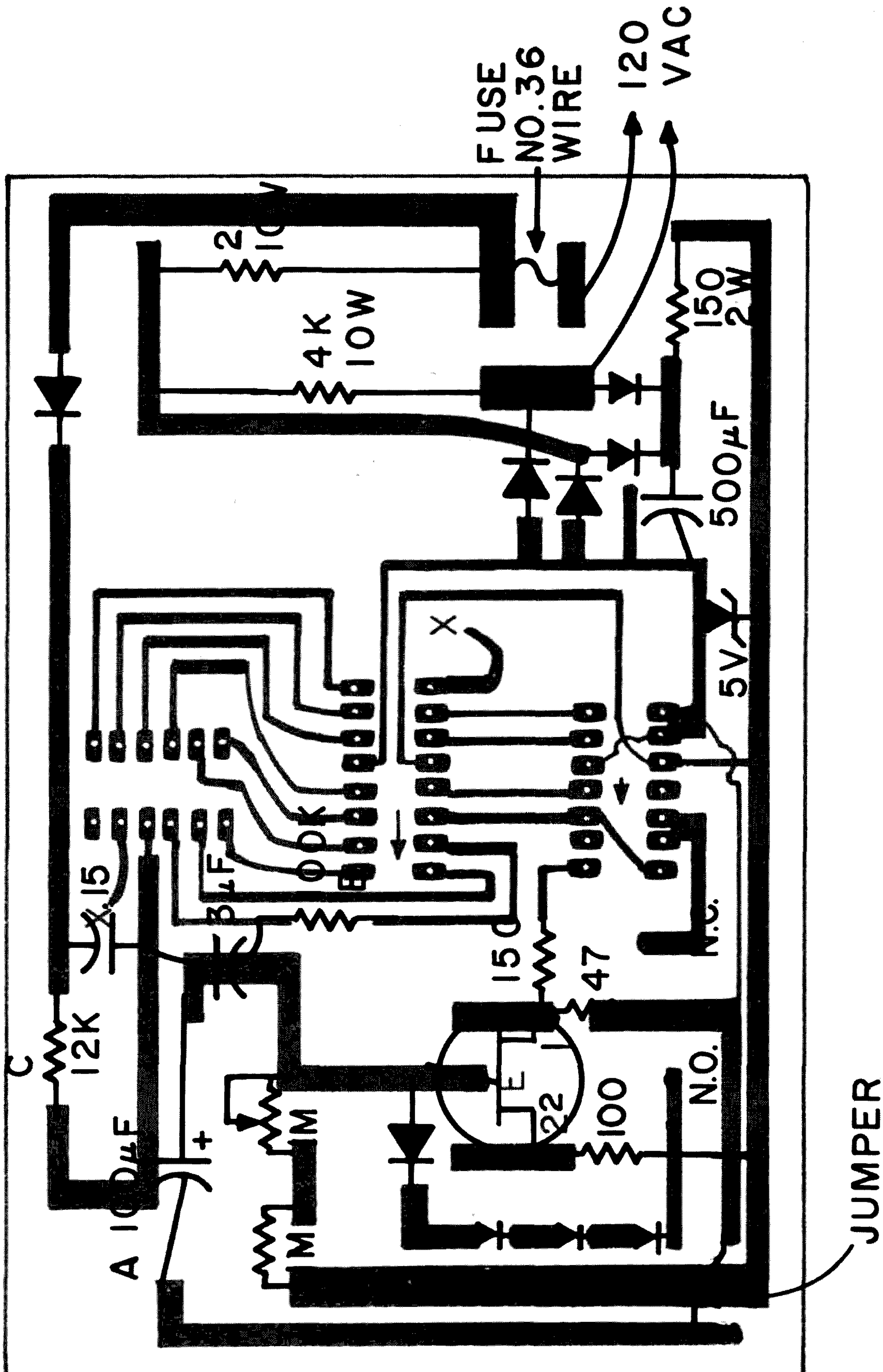

Fig. 1. All parts are mounted on foil side. A—If 100 μF cap has leakage greater than 10 μA, reduce the value of 1 meg resistor at timing pot as needed. B—"9" flash rate: adjustment of the 3 μF paper cap and 100k resistor may be necessary on some NIXIE tubes for desired flash rate. C—This value may be reduced for brighter display; check NIXIE data for maximum allowable current. X—Jumper.

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and

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Build An 11 dB Coatrack

We have designed and built parasitic beams for 2 meters at practically no cost that provide gains and front to back ratios comparable to commercial models. Our six element model gives about 11 dB gain and 14 dB front to back ratio, while our eight element model gives about 12 dB gain and 14 dB front to back ratio. Either model can be built for about two dollars.

Everything in electronics is a compromise. We sacrifice perfection for expedience, trade optimum performance for ease of operation, simplicity and reduced cost. But then, we need not compromise away excellence. One of the fundamental principles of engineering is to selectively compromise in order to obtain the best possible results under the circumstances; the creative use of the circumstances separate the men from the boys. Common examples of selective compromise are the tri-band beam and the familiar transceiver.

For those of you shaking your heads and mumbling "no compromise," let us put the advantages of ignoring results slightly less than perfect in a more concrete way. If you were to stand an engineer and a mathematician at one end of a room, and a voluptuous brunette at the other, then instruct them to take one step halfway across the room, the second step half the length of the first, the third half the second, and so on, the mathematician would never start, because he knows he will never reach his goal. The engineer will walk right over, knowing that whatever distance remaining after "X" number of steps will be negligible. Thus, the extra effort and expense to obtain the best possible is not always justified.

When operating VHF with low power, however, it is highly desirable to utilize an antenna which compromises as little as possible in efficiency and directivity. A no-compromise, high gain, efficient array can be constructed for a very small capital investment. The key to low cost in such an antenna is in the selection of materials of which it is to be comprised. We have constructed and tested two such arrays, a six-element and an eight-element Yagi for two meters.

The performance of these antennas has been exceptional. Yet quality must be designed into an antenna. High quality components will not make up for inferior design. Thus, we will first turn to the developmental stage of this experiment.

Design Parameters

Since we are frequent operators on the two meter band using low power, and our QTH is fortunate to have several repeaters within range, we required a directive array which afforded us a good front-to-back ratio, high efficiency, and rugged construction capable of withstanding high winds and severe ice loading. Our antenna must also be vertically polarized because all the local repeaters are vertically polarized. Cross-polarization means little after a few skips off the ionosphere, but when operating line of sight, it can mean as much as 14 dB or more

loss in signal strength. Finally, broadbandedness was desirable, since the operating frequencies of the local repeaters cover most of the 146 MHz spectrum.

Optimum spacing of elements was selected over less than optimum spacing and a greater number of elements, since this design affords an advantage in forward gain. A tapered director approach was also taken because of the increased bandwidth, with only slight reduction in forward gain. In this way we made our compromise to our advantage.

The first experimental antenna was a six-element array assembled on a boom slightly over six feet in length. The performance of this antenna was so impressive that a second array, built on a ten foot boom, and consisting of eight elements, was constructed.

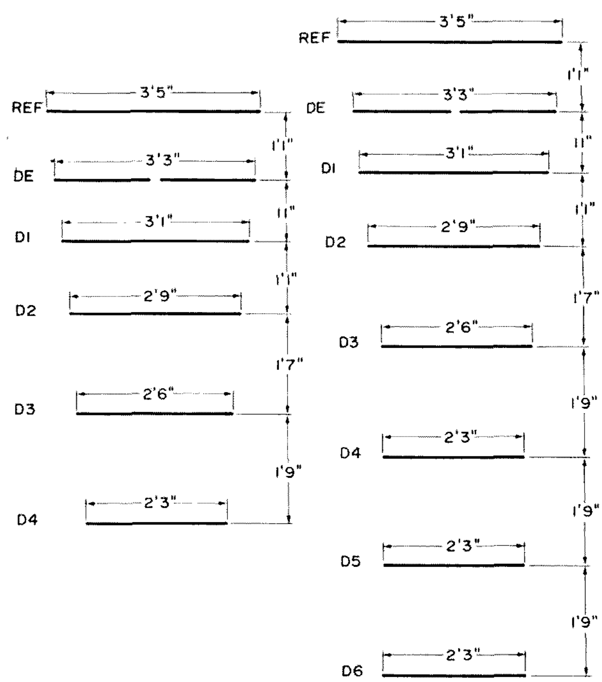

Fig. 1.

Fig. 1 depicts the dimensions used for both arrays, designed for 146.2 MHz. Fig. 2 shows these dimensions as a function of wavelength for the amateur who wishes to construct an array for a different resonant frequency.

Construction

As previously mentioned, the cost of these two antennas was next to nothing. The secret is in using 2½ inch diameter PVC for

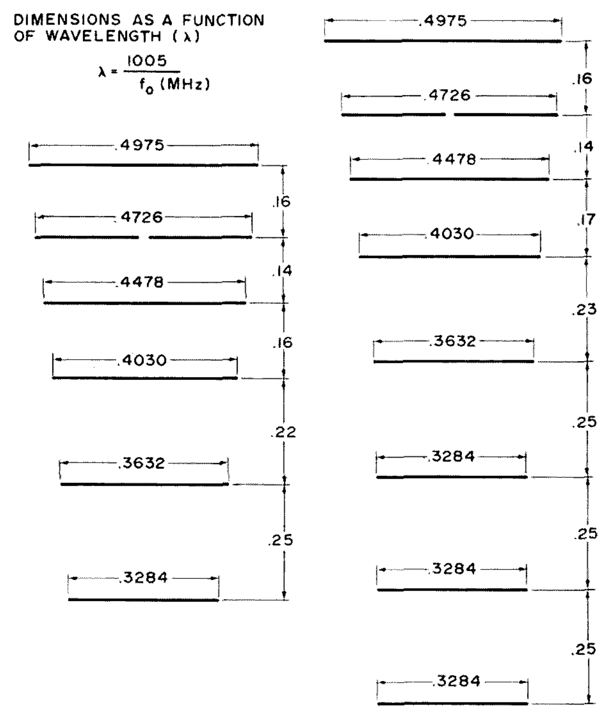

Fig. 2.

the boom, and coat hangers for elements. The PVC is fairly rigid, weather proof, non-conductive, light, comes in ten-foot lengths, and is inexpensive. Coat hangers are rigid enough to be self supporting at VHF, they are easily soldered, and are free. (If your closets are like ours, a semi-infinite supply of element material is readily available.)

The first step is to gather up enough hangers, cut off the hooks, and straighten them. We found the average length of the straightened hangers to be about 34 inches, so you can see that the longer elements must be made of two hangers spliced together. This is easily done by cleaning about an inch of the ends of the two elements with sand paper, overlapping them in a vise, and soldering them together. You will then have more than enough length. The driven element is a simple half-wave dipole, so remember to cut two pieces half the total length given in the formula. The half-wave dipole allows for simplicity in construction and tuning, and is also a more efficient radiator than a gamma or "T" matched driven element.

Once the elements have been cut to length, measure out the spacing on the PVC boom. Drill holes just big enough to allow the wire to pass through. Center the ele-

ments on the boom, and hold them in position with tape. Then apply epoxy glue to permanently bond the elements to the boom. Fig. 3 illustrates the finished assembly for the driven element and the reflector.

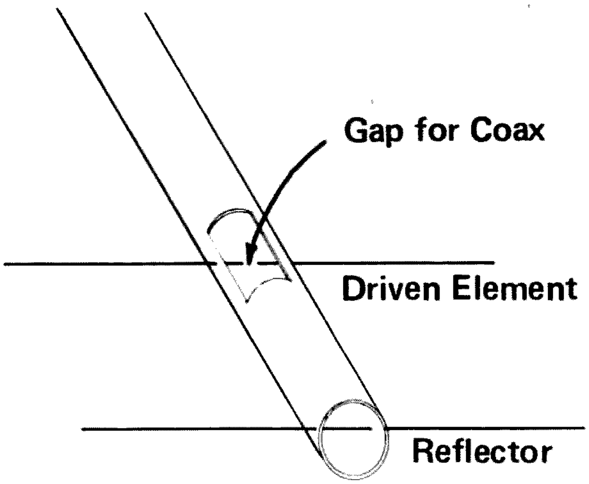

Fig. 3.

When the glue has hardened, the antenna is ready for tuning and pruning. Solder the coax to the driven element, and tune for minimum swr at your selected resonant frequency. We were able to obtain an swr of 1.05:1 at 146.16 MHz, climbing to 1.5:1 at 146.94 MHz. If we can extrapolate from this, and assume an swr of 2:1 as acceptable, then the bandwidth of this array would be in the neighborhood of 2 MHz.

Performance

Once the six element array was tuned, field strength measurements were made. The results showed about 11 dB forward gain and a front to back ratio of about 14 dB. We were able to work the WRØADF repeater located near Denver from our QTH in Colorado Springs with 30W. This is about 60 miles with high ground between us. Using 1W of power, we were full quieting through the WRØADR repeater located in Pueblo about forty miles away with no intervening terrain.

We then ran some field tests using a TR-22. Operating simplex from an automobile, we were able to maintain good communications with only 1W out to about twenty miles. Operating with the same equipment, except switching to a ground plane antenna at the fixed QTH, the maximum range of reliable communications was less than five miles. The eight element array was tested in a similar manner. It showed slightly better gain, about 12 dB, and about the same front to back ratio.

Of course, these figures depend upon how you tune your array. If you tune for maximum gain, there is some sacrifice in front to back ratio, and vice versa. You will have to determine if you want maximum gain, maximum front to back, or a compromise between the two.

. . .WBØDQC and WBØHKB

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Front Burner For Six

Solid State Two Stage Preamp

Although 6m FM is not enjoying the popularity that 2m FM is, there is still some activity between 52 and 53 MHz. Simplex coverage is somewhat better here than on 2m, and many people leave their rigs squelched on 52.525. When the band opens, one can have a great time.

Many surplus portables, usually the tube only or hybrid types, have appeared on the market at fairly low prices. I have a G.E. H-11 prog line portable that puts out about 1W, which is inadequate power a lot of the time. Using the amplifier to be described with it, I can get about 35W out, which represents some 15dB. I am in the process of building an all transistor, 1W exciter to replace the tube type that the G.E. uses, so I will end up with a completely solid state 35W transceiver.

This amplifier is easy to build, easy to tune, stable, lightweight and efficient. At 14V with 1W drive, the amplifier delivers 38W output and draws 4.7A. This works out to an efficiency of 58% overall. Like all class C amplifiers, it draws no current unless rf is put into it. No provisions for switching will be given here – see the article on 2m amplifiers in the April, 1973 issue of 73 Magazine for more information.

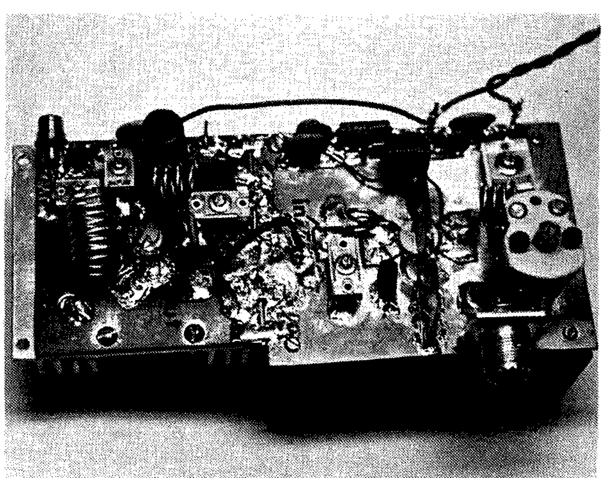
Circuit Description

The circuit, Fig. 1, actually consists of two separate amplifiers, each one being able to work into and accept a 50Ω impedance. If the amplifier is divided at the short piece of coax, you will have two separate amplifiers, either of which can be used alone.

The first stage uses an inexpensive device that was designed to run up to 100 MHz with 28V on the collector. It will give about 7-8 dB of gain on 6m *running* at 13-14V. I used the 2N3818 because of its price – they can be found surplus for one to three dollars.

The second stage uses a device that is designed to run on 12.5V up to 50MHz. If you have 4 to 6W of power available, this stage will give you about 40-45W out. If you do use it alone, add a variable capacitor of 25 to 280pF, such as an Arco #464, in series with the input to the junction of L3 and C7.

When I built these amplifiers, I did them separately. Later, when I decided to use them together, I combined them into one assembly. There is no reason why they cannot both be built on the same board and heat sink.



Construction

Construction of the amplifiers is simple and straight forward. A minimum of metalwork is required, and the pads on the circuit board (which must be glass-epoxy but need not be double-sided) can either be etched or cut out with a hand grinder. Be sure to use heat sink compound when mounting Q1 and Q2 – see Fig. 2. Q1 is a stud package with three pins on top. Connections to them should be made carefully so that they won't be broken. I used some scrap brass flashing to ground the emitter and to form a tie point at the collector, although heavy tinned wire could be used instead. The studs on both Q1 and Q2 are isolated, so they need not be insulated from ground.

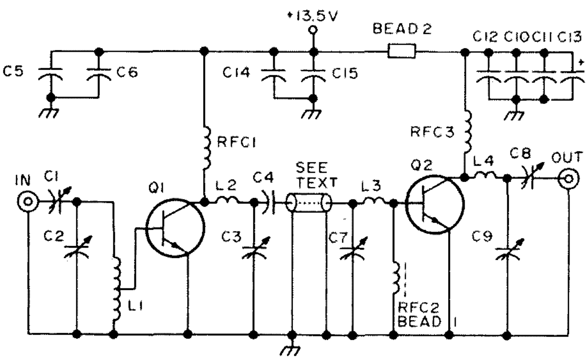


Fig. 1. Schematic of the 6 meter amplifier.

Q2 should be mounted according to the diagram in Fig. 3. Spacers should be used between the board and the heat sink so that the flat leads on the transistor are just above the pads on the board when the nut on the stud is tightened. It is important that the nut is not over tightened, and that you *do not solder the leads until the device is secure.* Once the transistor is mounted and soldered, put a metal shield over it as in the picture. A short length of coaxial cable, such as RG-174, is used to connect the output of the first stage to the input of the second one. (If desired, it can be eliminated and replaced with a short jumper wire if the two pads are situated close together, or the board can be made so that one common pad is used.)

Once construction is complete, apply +12 -14V to the appropriate pad. Connect the output of your 1W exciter to the input of the amplifier, and connect a wattmeter and a 50W (at least) non-inductive 50Ω dummy load to the output. Tuning is straightforward – adjust all capacitors for maximum output. Stretching and compressing the coils may improve output somewhat. Moving the tap on L1 also may increase the overall gain.

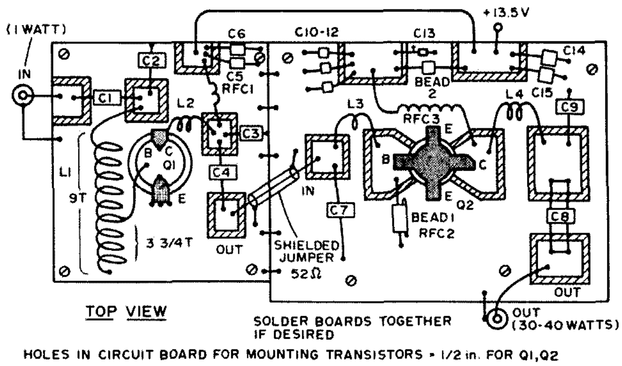


Fig. 2. Diagram of the amplifier.

A better way to tune the two stages is to do them one at a time. Tune the first one by removing the output going to the second stage and replacing the second stage with the dummy load and wattmeter. Tweak it for maximum, re-connect the second stage, and tune the second stage for maximum output. Go back and set *all* adjustments for maximum indication on the meter.

When adjustments are completed, you should get approximately the following performance with one watt of drive:

12V – 30W out
13V – 33W out
14V – 38W out
15V – 43W out

The amplifier should draw approximately 4-5A, depending on the voltage. The heat sinks on mine get just warm to the touch after several minutes of operation.

ONE WORD OF CAUTION: This is a class C amplifier which is fine for CW and FM. DO NOT TRY TO RUN AM OR SSB through it: It is not linear and so doing so will cause distortion.

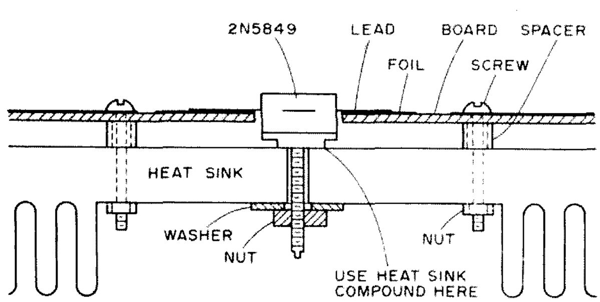


Fig. 3. Details for mounting Q2.

Parts List

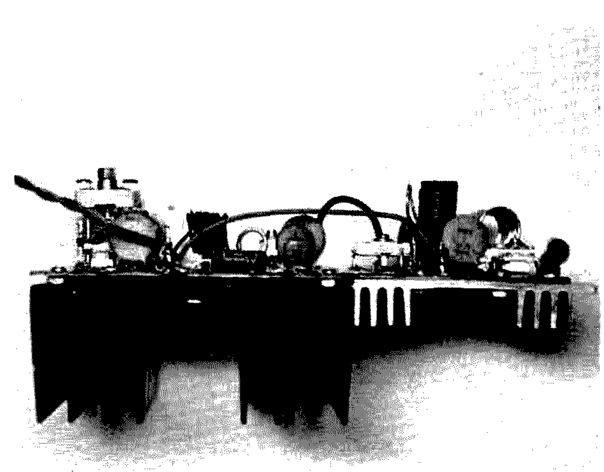
Capacitors

C1 8-60 pF mica (or Arco 462 or equiv.)
C2 8-60 pF mica (or Arco 462 or equiv.)
C3 14-150 pF mica (Arco 424 or equiv.)
C4 .1 MFD ceramic disc (at least 50V.)
C5 .1 MFD ceramic disc (at least 50V.)
C6 .01 MFD ceramic disc (at least 50V.)
C7 90-400 pF mica (Arco 429 or equiv.)
C8 10-50 pF air variable or mica (Arco 462 or equiv.)
C9 5-80 pF mica (Arco 462 or equiv.)
C10 .1 MFD ceramic disc (at least 50V.)
C11 .02 MFD ceramic disc (at least 50V.)
C12 .001 MFD ceramic disc (at least 50V.)
C13 1 MFD 25V electrolytic
C14 .1 MFD ceramic disc (at least 50V.)
C15 .001 MFD ceramic disc (at least 50V.)

Other Components

Q1 2N3818 transistor
Q2 2N5849 transistor
L1 9 turns #16 tinned wire, 1" long, ½" I.D., tapped 3¾ turns from ground
L2 4 turns #16 tinned wire, ½" long, 7/16" I.D.
L3 1 turn #16 tinned wire, 5/16" I.D.
L4 4 turns #14 tinned wire, 3/8" long, 15/32" I.D.
RFC1 22 turns #18 enameled wire, tightwound, 13/32" I.D.
RFC2 2½ turns through a 6 hole ferrite bead, or 2½ turns through a 3/8" one hole bead
RFC3 18 turns (9 over 9) #16 enameled wire, tightwound, 3/8" I.D.
Bead (in B+ line) 1 hole ferrite bead

. . . WB4DBB



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East Amherst NY

A Digital Dial for Your Receiver

The great majority of amateur radio stations in this day and age of digital techniques have some sort of frequency counter – or at least have construction plans in mind. Over the last few years 73 and other amateur magazines have published counter construction articles that can be built for $50 or less.

In writing this article, we are directing information to those who are the proud owners of both an AX-190 receiver and a digital frequency counter.

The AX-190 is a completely solid state receiver that is both sensitive and selective. Radio Shack stores sold these receivers a year or so ago and apparently have discontinued this particular model. It seems strange that a good receiver such as this was discontinued. However, it should indicate also that one can be obtained at a moderate price.

The digital dial converter certainly enhances the operating ease and accuracy of the AX-190. The converter will work with receivers other than the AX-190 with slight modifications. We will delve into this data later in the article.

The AX-190 is a dual conversion receiver with a first i-f of 2920-2940MHz. The second i-f is 455kHz. Main tuning is accomplished with a vfo that tunes from 3.375MHz to 2.875MHz. Following the vfo is a "built-in" buffer stage that feeds a jack on the receiver rear panel. Therefore, you have a vfo sample that is ideal to feed a frequency counter.

In operation, the vfo actually tunes "backward" from 3.375MHz to 2.875MHz to cover each amateur band. As an example, 21.000MHz = 3.375MHz and 21.500MHz = 2.875MHz. Therefore, feeding this vfo sample signal directly into a counter would not mean much as far as actual received frequency. You would have to make up a chart so as to interpolate vfo frequency and true received frequency. The fact that the vfo tunes backward would just add to the confusion.

There is also a jack on this receiver to sample the hfo frequency which means that a multi-stage mixer system could be created so as to add the hfo, 1st i-f, vfo and 2nd i-f. Adding the extra rf "take off" jacks and building a mixer such as this seemed like an expensive and complicated route.

When considering the backward vfo scheme, a simpler mixer system evolved. We cooked up a mixer so as to use only the vfo output sample and convert this directly to the received frequency. When describing the following frequencies, "x" will represent any of the megacycle (least significant) digits of amateur bands such as 21., 14., 3. etc... The tuning of the AX-190 is such that a vfo sample of 3.375MHz equals the band edge or "x" .000MHz. The lower limit of the vfo is 2.875MHz which represents "x" .500MHz or the upper band limits.

Considering that 3.375 vfo = "x" .000, a mixer crystal of "x" .375MHz above 3.375MHz would be needed, so as to, through subtractive mixing, indicate "x" .000MHz on your counter.

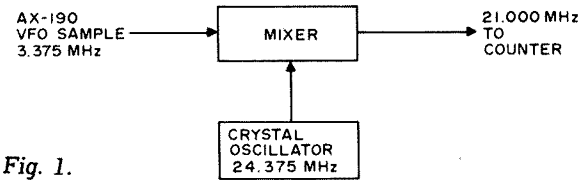

Fig. 1.

To provide a counter readout that would be "x" accurate on all bands or accurate to the last two insignificant digits, a series of mixer crystals would have to be switched along with the receiver band switch. Appropriate coils also would have to be switched in the mixer for various bands. This, of course, would be both complex and expensive.

The last four most significant digits are the ones to be most concerned with. The "x" or megacycle readout on the counter can usually be ignored provided your counter is working properly. Bearing this in mind, any crystal above 3.375MHz (high limit of receiver vfo) with the last three digits "x" .375MHz can be used as a mixer crystal.

Of course, the counter "megacycle" readout will be incorrect. However, the most significant digits will be accurate. Of course the mixer crystal will have to be accurate or the resultant counter accuracy will suffer.

Possible crystals that can be pressed into mixer service (with appropriate coils) are:

	Counter Readout	
Mixer Crystal	**High End**	**Low End**
4.375	1.000	1.500
5.375	2.000	2.500
6.375	3.000	3.500
7.375	4.000	4.500
8.375	5.000	5.500
9.375	6.000	6.500
10.375	7.000	7.500
11.375 (we used)	8.000	8.500
12.375	9.000	9.500
13.375	10.000	10.500
14.375	11.000	11.500
15.375	12.000	12.500
16.375	13.000	13.500
17.375 (correct for 20 meters)	14.000	14.500
etc.	etc.	etc.

In the case of 80 meters which begins at 3.500MHz and one 10 meter segment which begins at 28.500MHz, a separate mixer crystal of "x" .875MHz above 3.375 will give a proper mixer output for your counter.

Let's take an example using a mixer crystal of 4.875MHz: 4.875MHz (mixer) – 3.375 (vfo) = 1.500, 4.875MHz (mixer) – 2.875 (vfo) = 2.000MHz. Therefore on your counter, 1.500MHz would be 3.500MHz and 2.000MHz would represent 4.000MHz.

We might add at this point that your basic counter unit does not have to be modified when using this mixer scheme. It can be switched at any time so as to measure your transmitter or vfo frequency directly.

The mixer crystal that we happened to have in the junk box was 11.375MHz. Therefore, the coils in the mixer were designed about this frequency. Of course, crystals at 1/2 or 1/3 the desired mixer frequency can be used. When doubling or tripling the crystal frequency, it may not exactly come out "x" .375MHz.

In Fig. 1, Q1 is a RCA 40673 dual gate protected mosfet. Q1 is the mixer stage and is used with an "untuned" input stage. The receiver vfo buffer provides sufficient mixer excitation for this purpose so a resonant circuit was not placed in the mixer input. Excessive input voltage would not damage the 40673 as it is internally protected by built-in zener diodes.

Q2 is a 2N4416 mosfet employed as a crystal oscillator. D1 protects the gate of the 2N4416 from excessive voltages. Crystal oscillator injection for the mixer is coupled from Q2 to Q1 via a 22pF capacitor into Gate 2 of the 40673.

The resultant difference frequencies appear at the resonant drain circuit of Q1.

If the input circuit of your frequency counter is reasonably sensitive, you may be able to eliminate U1 (HEP-590) and couple directly to the drain circuit of Q1 through a small (15pF) capacitor. U1 was included as an rf amplifier so as to provide adequate gain for driving just about any frequency counter input stage.

Coil L1 resonates at 11.375MHz which is the crystal fundamental frequency. Coil L2 and L4 resonate at 8.0MHz which is the subtractive difference frequency of the mixer stage. Coil and capacitor arrangements will have to be altered depending on the "x" .375 crystal you use in the mixer/oscillator stage. A grid dipper is very valuable in adjusting the various coil frequencies.

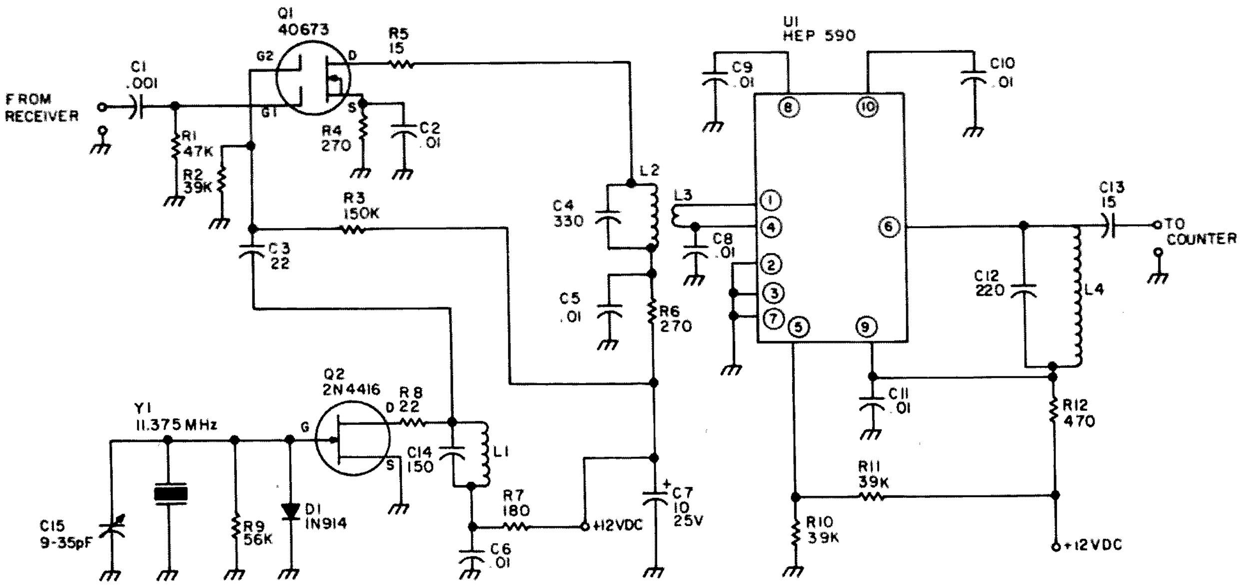

Fig. 3. Digital Dial Converter.

Parts List
(for Fig. 2.)

Capacitors

C1 = .001 disc, 100V
C2, C5, C6, C8 - 11 = .01 disc, 100V
C3 = 22pF disc, 100V
C4 = 330pF disc, 100V
C7 = 10mF, 25V elec
C12 = 220pF disc, 100V
C13 = 15pF disc, 100V
C14 = 150pF disc, 100V
C15 = 9-35pF trimmer

Diode

D1 = 1N914 silicon diode

Coils

L1 = 11T. #26, ¼" form
L2 = 11T. #26, ¼" form
L3 = 2T. hookup wire over L2
L4 = 11T #26, ¼" form

IC

U1 = HEP 590

Crystal

Y, = 11.375MHz xtal

Transistors

Q1 = RCA 40673 Mosfet
Q2 = 2N4416 Mosfet

Initial adjustment of the mixer crystal oscillator can be accomplished with the aid of your frequency counter. Apply power to the mixer and attach your counter to Gate 2 on Q1. Adjust the crystal trimmer so that your counter reads "x" .375MHz. The other method of frequency adjustment is to tune in WWV at 15MHz on the AX-190. The counter, when attached to the converter output should read "x" .000. Should this not be the case, adjust the mixer oscillator crystal so that the counter does indicate "x" .000MHz.There is no doubt that this mixer system with appropriate crystals/coils could be applied to other double conversion receivers with vfo's that tune backward. Determining the mixer crystal is the only major problem. Of course, a vfo sample would have to be extracted ideally through a small transistor buffer stage for vfo isolation.

Power supply requirements are minimal and any small 12 Vdc supply will work well. If you are really under pressure to test your unit, a 12V lantern battery will work well and last a long time.

... **W2AOO**

It's a fact

You think old Sam Morse invented electric telegraphy? Don't make any bets on it! Sam invented the electromagnetic telegraph, but several forms of electrostatic telegraphs had been in use many years before Sam got into the act.

When and in what country was the first television receiver made that employed a cathode ray tube to display the image? In 1906, in Munich, Germany.

... **W5JJ**

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Three on Fifteen

The purpose of this article is not to say "Presto, here is the absolute final word in the way of building a 3-element beam for 15 meters," but to bridge the gap (if there is one) between the antenna theory manuals and the actual construction of the antenna. In doing so, we will look at some of the problems I ran into in building one for myself in the hope that prospective antenna builders may benefit from my problems and their solutions. The ideas advanced here can also be applied to a 10 meter beam construction and to some extent on 6 meters. The use of my cheapie construction methods would have to be altered considerably to apply to antennas for the lower frequencies (20, 40 meters, etc.).

In the actual construction, as well as for prelminary study before beginning construction, I used *Beam Antenna Handbook* by William I. Orr W6SAI (3rd Edition). It is a very well constructed book and I couldn't have done as well without it. I reference p. 102 for the basic design curves and p. 113+ for the information on the gamma match construction details.

I did not – from here on – stick to the strictest of W6SAI's specifications. As I mentioned before, I went "cheapie." This article, therefore, may appeal to the novice or any other with a limited budget. My first deviation from the Handbook was to use small size tubing for the elements. This narrowed my frequency coverage over the whole band but as I operate near the top end of the band most of the time, this did not present a problem.

The tips of the elements are of TV antenna 3/8 in. O.D. aluminum tubing that I salvaged from the reflector section of an old Davis fringe area antenna. These were in 8 ft lengths and I used 6 of them. These telescope beautifully into the ½ in. O.D. tubing that was used for the center sections (Fig. 1).

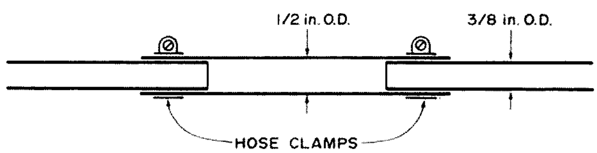

Fig. 1.

This ½ in. O.D. tubing is the kind that can be obtained at almost any scrap metal yard or through government surplus. The person who wants to buy it outright can get it at almost any electrical supplier of conduit. The tubing I used was one of the softer varieties and this seemed to be a boon, as I will explain later.

As far as the actual mounting of the elements to the boom, I used regular TV type U-bolts and clamps with a short section of square conduit notched with a long vee under the elements for added strength at the mounting point (Fig. 2). This length of

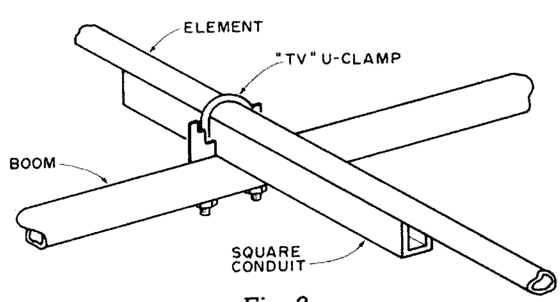

Fig. 2.

square conduit can be from 36 to 48 in. long, at the discretion of the builder. There is quite enough leeway in the mounting so as to leave the rest to the imagination and resources of the builder.

The boom is of three 5 ft lengths of TV antenna mast of the sort that will fit end into end for extension use. This gave me a boom of a little less than 15 ft in length. I used the galvanized type, although I'm sure the aluminum could be used equally well if a little more care is taken not to tighten the nuts on the U-clamps too much and cause the boom to collapse.

Attachment of the boom to the mast was done with a homemade mounting bracket consisting of an 8 x 8 in. piece of 3/8 in. plywood sandwiched in between two 8 x 8 in. pieces of galvanized sheet metal (I found mine in a scrap pile) and four of the same kind of TV U-clamps.

None of the articles I have read ever said whether or not the gamma match unit should be mounted in line with the elements or under or above them, nor whether the gamma should go in-line with the elements or under or above the driven element. The W6SAI handbook is the best I've seen on the gamma match. It gave me at least a direction to start with, and I ended up mounting the gamma "box" on the boom behind the driven element with the gamma rod extending to the right, in line with the elements and about 5 in. behind the driven element. The rod was a 48 in. length of TV antenna tubing I salvaged from the reflector of an old conical TV antenna. My shorting strap was made of this same type of tubing about 7 in. long with the ends bent at right angles about 1 in. from the ends to maintain the 5 in. spacing of the gamma rod. This shorting rod was clamped onto the driven element and gamma rod by use of hose clamps over the respective connection and the 1 in. section at the respective end of the shorting rod. This shorting strap was placed 30½ in. from the boom. This distance may vary in each situation as the ground over which each individual antenna is mounted varies. I used a 120 pF variable capacitor for the gamma capacitor. As this capacitor must be mounted above ground and all standard units are rotor-ground units (and new floating variables cost good money) I cemented some insulating material in the bottom of an aluminum minibox on which to mount the capacitor. I drilled a hole in the box for the capacitor shaft to extend through and fitted the hole with a rubber grommet which fit around the shaft snugly. I then tied the capacitor to the box with nylon cord. The back of the box was fitted with a coaxial jack to facilitate removal of the coax transmission line, which was, by the way, 52Ω polyfoam RG-8/U.

Here again is where things started to depart from the Handbook specifications. When I completed it and began to try to tune it, it didn't want to cooperate. I then borrowed an antennascope-wattmeter and grid dip meter from John K5HIH, and found the resonant frequency to be about 21.55 MHz – too high. This is where the telescoping elements came into play. My final lengthening of the elements came out somewhat off as far as theory goes, but all I can say is that it works (Fig. 3). The spacing

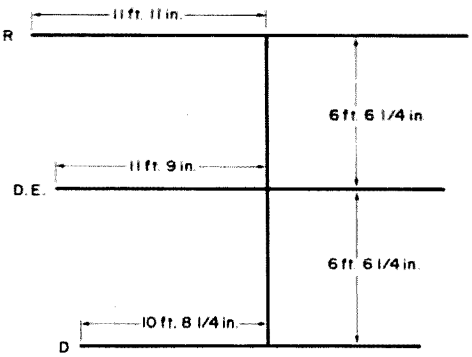

Fig. 3.

between elements remained the same as I calculated from the formula but the element length didn't remain true to the formula. The moral is, don't pull your hair out if the meters and signal reports say it is right but it doesn't measure out right. Accept it!

How does it stand up in the wind? Well, I constructed it in March 1970 just in time for the March winds and it withstood those upwards of 60 mph just fine. Three elements on the right side were bent slightly in November 1971 when we had a blast of tornadic winds upwards of 100 mph. Straightening them was no problem as I was taking it down anyway to move from the front to the back of the shack. It is mounted on a telescoping TV mast and slides up and down beautifully because of the antenna's light weight. A light-weight TV rotator can be used if a thrust bearing is employed. The softer tubing, as I said previously, was a boon. It allowed me to bend the elements

back into place by hand and with no apparent weakening of the element as happens quite often when straightening the harder elements of a TV antenna.

Performance? Beautiful. One of my first QSO's using the antenna was with OA4AEN/4, Clif. A minister friend of mine was in the shack and I was demonstrating the equipment when we heard Clif. My friend said, "I want to talk to him." Clif, by the way, is a missionary pilot. I fired at him and he returned the first thing. He asked how many kilowatts I was running, to which I replied only 400 watts from a Galaxy V Mk2. His reply to this was, "Well, they must be 400 Texas size watts."

From here, it's up to you. Try it, use your own imagination, draw your own conclusions, and the best of DX to you. The swr on mine was about 1.2:1 at 21.45 MHz and a little less than 2:1 at 21.35 MHz. I haven't noted any appreciable difference in performance over this range of frequencies. I'll be looking for you some afternoon on a weekend when the skip comes rolling in.

. . .WA5CNG

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More Weather Satellite Pictures

In a series of two articles in 73 (September, 1974 and December, 1974) I described a simple video adapter that allows weather satellite pictures in the APT and DRIR modes to be displayed on a conventional SSTV monitor. The response to these articles has been rather startling and indicates a high level of interest in this type of activity. Sorting through the multitude of reader questions in regard to the articles, I find they fall into three general categories. Are there any new circuit ideas that can be incorporated into the system? How can I utilize the circuit if I have a Robot or Brand X monitor? If I don't have an SSTV monitor is there any way I can use the circuit for picture display? This article was prepared to answer these and other questions. It will describe a 2400 Hz crystal controlled sync reference system, a 2400 Hz video bandpass filter to improve video display in the presence of noise, and an external deflection system that permits the adapter to be used with any electromagnetic SSTV monitor or even an old TV set!

The 2400 Hz Sync Reference Source

In the original series of articles the PLL of the sync system was locked to the satellite signal as the timing reference for the sync system. This approach was chosen because it permitted the use of a monaural tape recorder and therefore simplified the equipment requirements for picture reception. There are two limitations to the direct lock approach for the PLL that may on occasion cause some difficulty. A prolonged interruption of the satellite signal due to aircraft QRM (on the ATS frequency) or prolonged fades in the case of ESSA or

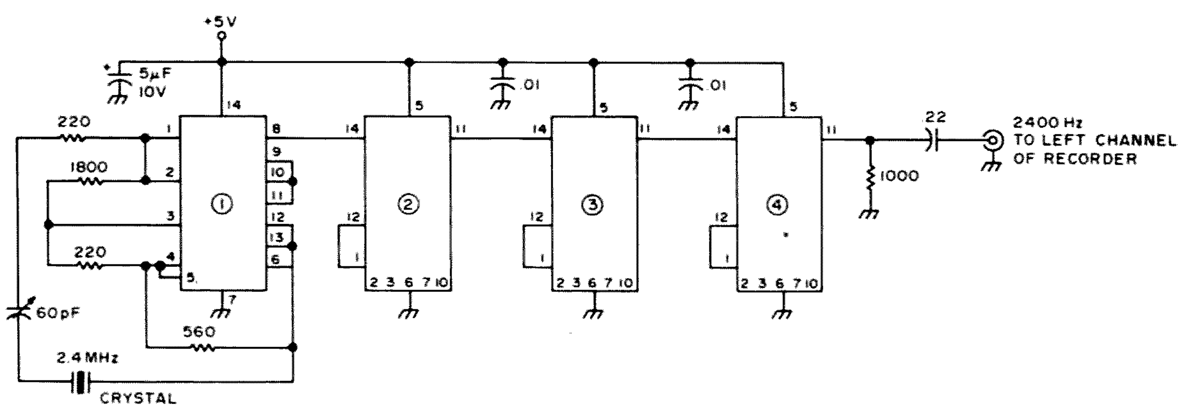

Fig. 1. Schematic of a suitable reference unit. IC1 – 7400, IC2,3,4 – 7490, xtal – commercial standard (AT cut), enclose osc. schematic when ordering from International or other mfg. co.

NOAA signals can cause the PLL to unlock, resulting in a picture phasing error. Additionally, the subcarrier duty cycle of the NOAA satellites can be quite low during night passes when the visible channel is black causing some difficulty in maintaining a locked condition. If a stereo recorder is available for satellite use it is possible to get around these problems by recording a 2400 Hz signal of high stability on one channel of the recorder while the satellite signal is recorded on the alternate channel. During playback it is possible to lock the PLL to the 2400 Hz reference signal and maintain proper phasing even if the satellite signal is obliterated for extended periods of time. Fig. 1 shows the schematic of a suitable reference unit. A 2.4 MHz commercial standard crystal controls the operation of a square wave oscillator (IC1). This signal is divided by three decade counters (IC2, 3 and 4) to provide an ultra-stable 2400 Hz reference signal. This signal can be recorded on the left channel while the satellite signal is recorded on the right channel. During playback the output of the right channel (satellite video) drives the adapter video circuits and the left channel output is routed through the phasing switch to the input of the PLL. Fig. 2 shows the adapter modifications. A number of articles on facsimile type displays suggest using the 60 Hz line frequency as a reference source but this is rarely satisfactory. Although the long term accuracy of the line frequency may approach that of the satellite subcarrier (2400 ± 0.014 Hz) the *short term* accuracy comes nowhere close! Any attempt to use the 60 Hz line source as a reference during recording will almost certainly result in wandering line rates. Given normal room temperature variations, the reference system described here is always right on frequency. If set up as shown in Fig. 2, you can still use the satellite signal for reference should the left channel recording fail for some reason or if the stereo recorder is temporarily out of service and a monaural machine must be used.

Video Bandpass Filter

The quality of the video display can be improved in the presence of noise if a

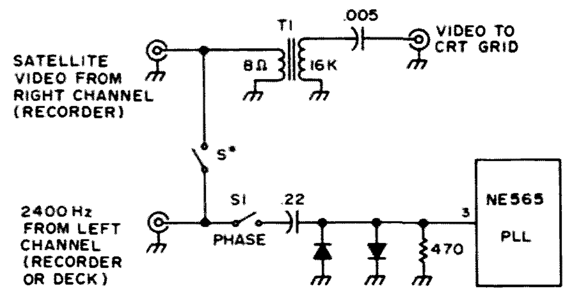

*Fig. 2. Changes in the satellite converter if the 2400 Hz reference is used to lock the PLL. *Adding an additional SPST switch here permits the PLL to be locked to the satellite signal if the reference recording failed or a stereo recorder is not available. Normal operation with the reference signal involves keeping S* open; close it for locking on satellite video.*

bandpass filter, centered on 2400 Hz, is inserted in the video line at some point in the system. Fig. 3 shows an active filter using a single 741 op amp. The filter is set up for approximately unity gain, a center frequency of 2400 Hz, and a bandwidth of 1000 Hz. Ideally such a filter would be 1600 Hz wide for APT use but narrowing it to 1000 Hz has no noticeable effect on APT reception and is a good match for the 900 Hz video bandwidth of the NOAA visible channel. There are two ways in which the filter can be used, depending upon whether a tape recorder or tape deck is used. In the case of a recorder the simplest scheme is to insert the filter in the record line as indicated in Fig. 4a. In this way the signal is cleaned up prior to recording and the output of the recorder can drive T1 with the previously filtered signal. Some operators would like to be able to use a tape deck with the satellite signal. Fig. 4b shows how this can be accomplished. The filter is inserted between the deck output and a small 1 Watt audio amp which then drives T1 in the video circuit. Any one of the many discrete component boards of IC chips may be used as long as the amplifier will supply approximately 1 Watt into the 8 Ohm winding of T1. I use a small amplifier board available from Radio Shack. The gain control of the small amplifier is thus used as the system contrast control. The extreme sensitivity of the NE565 PLL permits the left channel of a tape deck to drive the PLL with the sync reference signal without additional amplification.

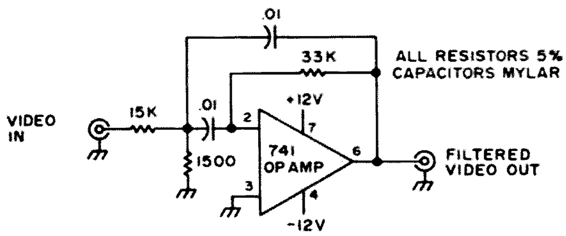

Fig. 3. Basic 2400 Hz bandpass filter.

External Deflection System

Proper video modulation of the monitor CRT can be achieved by running a shielded lead to the grid as described in the original article, but monitors such as the Robot which use continuous running sweep circuits instead of the driven sweeps of the WB8DQT circuit present a problem in terms of getting proper triggering and deflection for weather satellite display. The deflection system diagramed in Fig. 5 can solve this problem. The circuit is essentially a modification of the standard SSTV deflection circuit used in the W6MXV monitor and W9NTP flying spot scanner (both described in the 73 SSTV handbook) and in my own monitor circuit. A single pole single throw switch changes discharge capacitors for the APT and DRIR modes and the two size pots can be calibrated for the two modes. S1 resets the vertical sweep when closed and initiates it when opened. With the mode switch (S2) in the APT position close S1 and adjust the vertical centering so the trace is at the top of the CRT. Open S1 and adjust the vertical size pot for a 200 second sweep time from top to bottom. Use a pointer type knob on the vertical size pot and mark the proper position for the APT 200 second sweep. Use a similar knob for the horizontal size pot and adjust horizontal size and centering so the raster just sweeps across the bezel when driven by the APT trigger pulses from the adapter. Mark the position of the size pot for future reference. Place S2 in the DRIR position and adjust the vertical size pot for a six minute vertical sweep when S1 is opened. Mark the position of the pot for DRIR display. Adjust the horizontal size pot for a raster that sweeps slightly beyond the right margin of the CRT bezel when the mode switch of the adapter is in the DRIR position. Mark the appropriate DRIR position on the horizontal size control.

Fig. 6 shows one way of interfacing the external deflection system with the Robot monitor. An eight pin Cinch Jones plug (P-308AB) is mounted on the rear of the monitor. A dummy socket (S-308CCT) wired with jumpers permits normal SSTV display while another socket (S-308CCT) on a cable will interconnect the Robot deflection coils with the external deflection unit. A similar plan can be used to permit satellite picture display on a small TV set. Remove the TV yoke from the CRT but do not disconnect it. This will permit the set's HV circuits to function and lets you restore normal TV operation with a minimum of trouble. Obtain a replacement yoke to fit your set and connect this yoke to the external deflection system. A shielded lead from the set CRT grid to the video output of the satellite adapter completes the job. When interfacing the deflection board with either an SSTV monitor or a TV set, proper yoke polarity can be checked by closing S1 on the deflection system. The vertical trace should reset to the top. If it goes to the bottom reverse the vertical yoke connection, preferably on the plug at the end of the cable from the deflection unit. Shorting out the horizontal discharge capacitors should cause the trace to displace off the left hand side of the screen – if it moves to the right, reverse your horizontal yoke connections at the cable plug. In the case of the Robot conversion, should the SSTV picture be upside down or backwards in terms of the horizontal scan, make the appropriate changes in the jumper wiring on the dummy plug.

As in the case of the original conversion

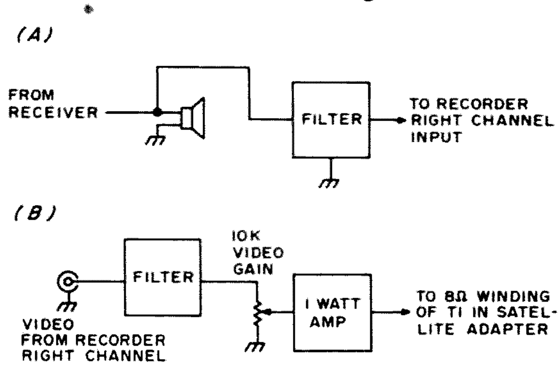

Fig. 4. Use of the video filter if a tape recorder (A) or a tape deck (B) is used. In the case of a deck, the left channel reference output is sufficient to drive the PLL (see Fig. 1).

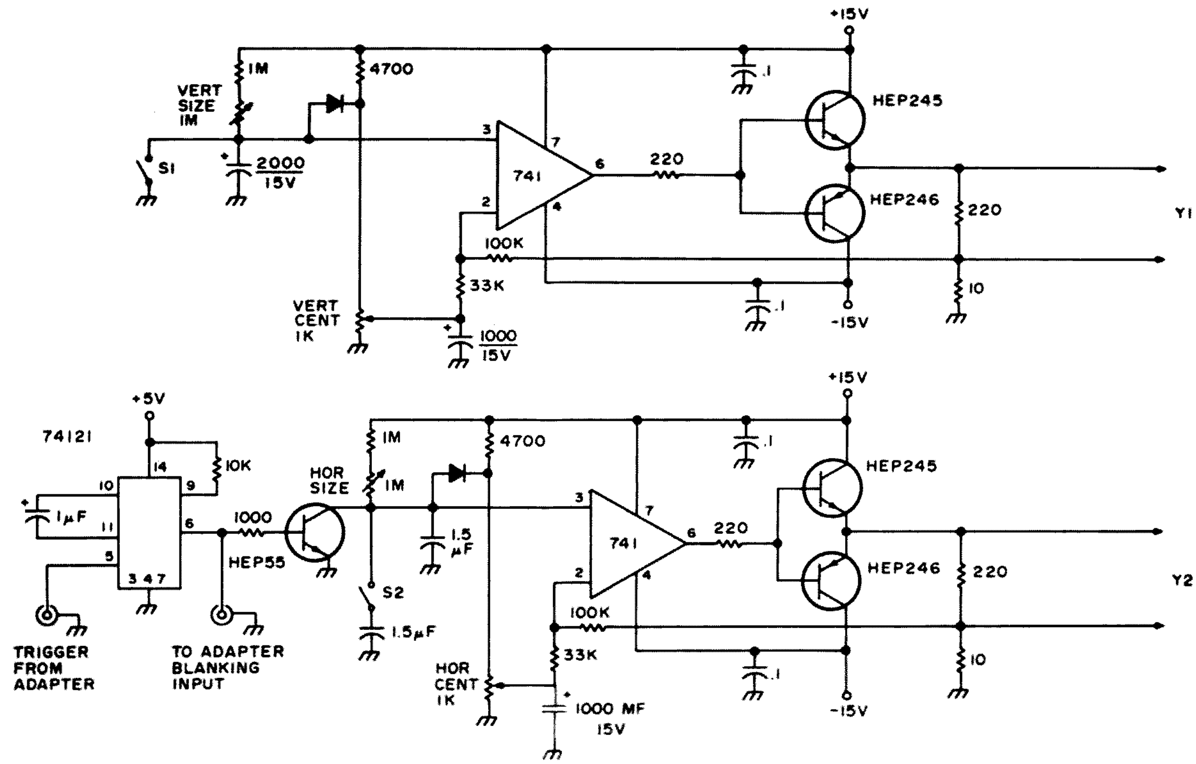

Fig. 5. Vertical and horizontal deflection system for utilizing the adapter with Robot monitors or TV sets. S1 functions as the vertical reset when closed, initiating vertical sweep when open. The 74121 IC is a 5 ms single shot that produces a trigger pulse when driven by the countdown chain in the adapter. This pulse drives the horizontal ramp generator (HEP55) and also provides a pulse to operate the retrace blanking circuit (Q1) of the adapter. S2 is the mode switch (open = APT, closed = DRIR). Use knobs on the size pots so that the proper APT and DRIR positions can be marked. Y1 is the vertical winding and Y2 the horizontal winding of the Robot or TV deflection coil assembly. If the deflection system is used with the Robot monitor the + and - 15 volts can be obtained from the camera power socket on the rear apron.

with the WB8DQT SSTV monitor, proper size and phasing adjustments are easy to make with an SSTV monitor because of the persistence of the P7 phosphor. In the case of display with a TV set, a square area should be masked out on the face of the CRT and size adjustments, as described, should be made in a darkened room to compensate for the short trace persistence. With a little practice, phasing adjustments are quite easy despite the short persistence of the P4 phosphor. However, you will have

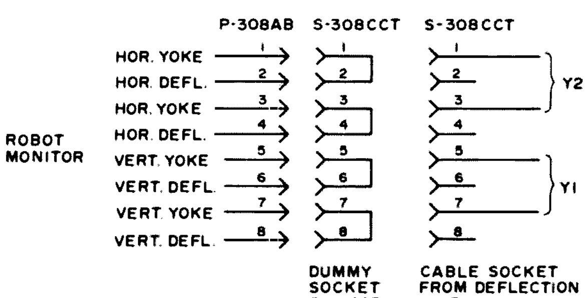

Fig. 6. One possible scheme for interfacing the deflection unit with the Robot monitor. Inserting the dummy socket on the new plug at the rear of the SSTV monitor restores SSTV deflection.

to depend entirely on photographs for picture interpretation; unlike the P7 phosphor, the P4 will not hold enough of the picture to be useful for visual evaluation. With both the TV or SSTV monitor approach the brightness control should be adjusted for a barely visible trace with no video from the adapter. Signal level from the adapter is then adjusted for a reasonable white level without blooming.

The addition of the crystal controlled sync source and video filter to the basic satellite adapter will result in a unit that is fully comparable to commercial units costing many thousands of dollars. The addition of the external deflection board will permit interfacing the satellite system with any SSTV monitor or monochrome TV set. The latter approach is particularly desirable for those without access to an SSTV monitor and should find particular application for low budget educational institutions that desire high quality satellite display.

. . .WB8DQT

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Solid Gold PR: Washington!

The interview has ended. We walked away, looking back at the long, yellow and white striped tent. The luring di-dahs of a CW contact met our ears. Even the unfortunate souls who have not been initiated into hamdom are fascinated by the code. Its mysterious, elusive, almost hypnotizing quality demands your attention.

And just as the code is so enticing, so is the whole hobby. Just as I captured your attention with my first paragraph, we must capture the attention of the public with good publicity. Too many dedicated hams work thousands of hours unbeknownst to their neighbors and friends. How often the ham remains unnoticed, until he has a TVI problem, when amateur radio is then shown in a less than favorable light. This kind of scrutiny is not desirable, because long after the TVI has been rectified, the ham is remembered only for his interference, and not for his good deeds.

One of the numerous ways to invite interest is to perform services that are beneficial. Other ways to draw the public eye, subtly, are through the arts and crafts that make up the history of our country. These vehicles of advertising ham radio take the public down memory lane, which is usually a pleasant experience for all. Reminiscing is an enjoyable pastime. It's harmless, fun, and best of all. . .cheap! Like free! I present for your criticism the following example of ham radio at work in the community. We all love our hobby, but it must be presented to the public before they will have the desire to take part.

Stretching from the Lincoln Memorial to the Washington Memorial was a swarming mass of humanity. The cool, refreshing water of the reflecting pool, usually peaceful, was dotted with people wading. A large raft slowly made its way back and forth, transporting people from one side to the other. There were huge tents, striped with many colors, pavillions, long, brown mobile homes (for staff use), golf-type vehicles to convey people, and small carts pulled by ponies. People were walking, people were jogging, and people were! Lots of people! Park Police on beautiful horses plied their way through the throng. Vendors peddled their wares, while the more easily exhausted folks sprawled on the grass in a variety of positions. Some slept, with the noonday sun hot on their backs.

Music came from all directions, trying to attract the passers-by. Songs of many countries filled the air. Dancers vied for attention, as they performed the dances of their native countries in brightly colored costumes. Palate-tempting aromas and the fragrance of spices promised a real culinary treat to the hungry.

All this activity was centered in our nation's capital, July 3-11, 1974 – the annual celebration of the Festival of American Folklore, sponsored by the Smithsonian Institution.

There were representatives of six labor unions, Native Americans from twenty two tribes, and dancers from Scandinavian, African, and European countries. This year's featured state was Mississippi.

Amateurs (too many to list here) were prominent in the group called Working Americans. Many clubs from the Washington area, including Virginia and Maryland, had tables with displays to illustrate the purpose of ham radio, hoping to enlist a few of the spectators. ARRL had a well manned (for you Women's Libbers, well personned) table set up to collar prospective hams. Several rigs operated to demonstrate what a QSO is. The special call WW3FAF (Festival of American Folklore) was used. Hams from many states signed the guest directory. There was an almost "Hamfest" atmosphere, as old friends renewed acquaintances and caught up on the latest news. It was reminiscent of Field Day, except for the absence of the familiar generator hum.

Forest, my OM (W4QVL), is with the Voice of America in Washington. He had the brilliant idea that the women listeners in other parts of the world, might be interested in the part YLs have in the festival each year and in amateur radio. Augusto Meyer, of the Brazilian service of the VOA, agreed with my OM. American women are envied world-wide and have infinitely more privileges. This fragment of an idea emerged as an on the spot interview with this befuddled lady type ham.

Proving that I am not an imbecile twenty four hours a day, I hastily sought the help of Dexter Anderson W3WKJ, of the State Department and the State Department Radio Club. He was an unending source of information, well informed on the elementary, as well as the more exotic, phases of amateur radio.

We were lucky to get Ethel Smith De Bardeleben K4LMB, who had some wise words about her part in the organization of the WAYLARCs (Washington Area Young Ladies Radio Club), the role of YLs in the ARRL and YLRL, and their varied interests and activities in the many facets of ham radio.

Besides taking numerous notes, Augusto, aided by his lovely and talented wife, Lina, recorded with a small cassette recorder, as we led him through the various displays in the big tent. Amateur TV, a solar power

source, and films featuring Arthur Godfrey and Barry Goldwater were all on hand. A phone and CW contact were recorded.

Augusto, speaking in Portuguese, described the setting and then introduced each speaker. The ham spoke in English, which was faded down later in the broadcast while the Portuguese was dubbed over. This kind of recording, called "actuality", carries more realism and credence than a purely Portuguese one. What was to be one broadcast expanded into two broadcasts of fifteen minutes each. The first one was on September 28 at 2300 GMT, on sixteen, nineteen, twenty five and thirty meters. The second was on October 4. There is a possibility that this kind of broadcast may extend into the other 35 language services.

The interview had ended. Another blow was struck for amateur radio, which needs every bit of good publicity it can get. Everyone of us can do our part, large or small, to spread good will in the name of ham radio. Every now and then, a good article gets published, pushing the cause of Ham. With the CBers, and the general public as well, bad mouthing us, it behooves us – each of us – to say a good word or do a good deed, that can be a credit to hams, every chance we get. Such things make better people out of us, too.

There was a great deal of confusion, to say the least, as we walked among the displays. QSOs on four different bands for a starter, but unlike many people, the hams did not mind having a mike thrust in their faces. They kept their QSO going as though they had expected the whole thing. They maintained their cool. We do like to think of ourselves as level headed and able to function in many situations.

The old ham urge to help prevails in every possible circumstance. As we walked through the exhibits with Augusto, speaking in Portuguese, a ham came up to volunteer a friend who spoke Spanish and "would help to translate for us". The language was not Spanish, and the purpose of the interview was to provide on the spot realism, but the guy was ready to help. Which goes to prove that a ham will be there to help, even if he doesn't know what is going on.

. . .K4SHE

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Tit for Tat and others

Once upon a daylight losing time, there lived a spouse/ham/kid combo named Tit, Tat and offspring Jean or Gene (a gray area). They were all MORE than normal - - - let us say their combined I.Q. was underwhelming. He operated an ice cream parlor in Brainsprain that was so small it had one different flavor.

The tall storm fence around his spread had been erected in a crash program by the neighbors. It was designed to keep things in, not out. As a whole, Tat's shack certainly was - - - it was about as neat as a seal harem in a snow storm. Some glory for this went to little one's cute habit of warming his/her weenies in the linear. He had spoken at great length about this. The swr meter was calibrated Forward, Reverse and Carry-Out. After long-accumulation of oozings, flames licked from the lo-pass filter during hot DX joustings, making the premises smell like a Ubangi bake-out.

The five-yearly maintenance caper always started with pulling the wall breaker and making cautious passes with a mine detector and roto rooter. Tat was outstanding in miner's hat and lantern in the blackout.

Just no end to his ingenuity. One day his Honda came uncranked and he jumper-started his roto tiller from the trolling motor, so he could jump-start his Honda from his roto tiller.

"Where'd he get such talent?", asked Bassmouth, a fat priceless neighbor.

"It came with his genes!" blurted Tit.

"But he's not wearing jeans," echoed BM.

"Jean's not wearing his either," said Tit, logically.

"Who, me?" said little bit, playing with its natterjack.

"Pity!" said someone.

"What'll it cost to spring me from here?" groaned Tat.

On another memorable day Tat thought most of his rf was avoiding the antenna somehow. Tit was programmed to push the key on command, while he was thrusting the box at the bottom of the crank-up.

At a crucial moment, Bad Humor Girl tripped over her low-hung accouterments and lost an ear screw, which welded across the Navy key points. Promptly, Tat became the hottest item in a sleet-melting network and the air departed his framis with vast gusto. The automatic tower crankdown detector felt this as a high wind and lowered his boom. But Alas! The smarts box seeing its error suddenly erected his boom to a devilish angle and the RG-17 Slash U lifted him by the vital apex.

Thus inspired, he seemed to breast-stroke thru the air - - - he wasn't even near the wench! At half-mast, he trapezed merrily thru the Gamma match, which proved quite fitting at the vernal equinox.

He was no match for the Gamma match, and lady misfortune aimed him towards ground zero. He made two big points into a basketball goal he had cleverly welded onto the tower - - - he contacted nothing but the iron rim. A great shudder ran along the coax into the shack, so mighty that it uncoupled his antenna coil.

Dangling sunny-side-up from the net (he'd been in some before), he saw things differently. Man, he needed a break! and it was coming to him – the winch crank, placed there for those delightful powerless moments, turned on him and clobbered him roundly in the guess where.

"What was that all about?" yelled Tit, her face screwed into a granny knot, and even more unbalanced without one ear screw.

"Oh, I just felt unnecessary, lying there doing nothing," he garbled, grabbling for his dentures in the Zoysia.

"That was simply beautiful," signed his neighbor Bedlam to the east, as he hit a hot lick on his gusle. "But I missed the intermezzo - - - would you do it again?"

"Double pity!" said Bassmouth, the philharmonic neighbor, wearing his hard hat for the luau.

Conclusion: Some neighbors just don't know what they're missing.

. . . W4ATE

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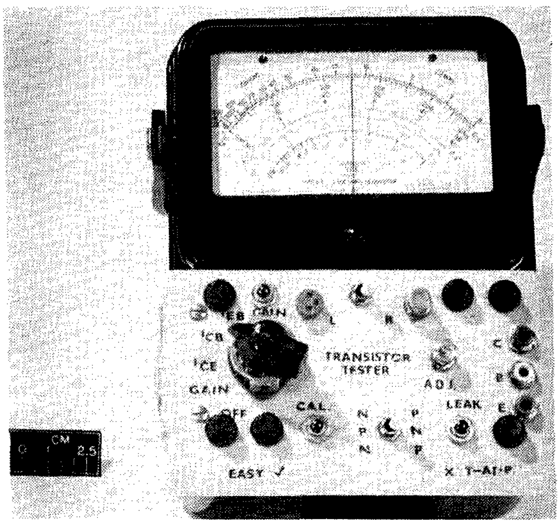
PRESTO!

Transistor Checker from VOM.



Transistor tester (mounted).

Vacuum tubes and transistors have to be tested in special testers usually in the shop or lab, to determine their condition or defect. This still holds true for vacuum tubes but, because the transistor has advanced so rapidly and become so popular in the electronic field, it has been difficult to test.

Many good transistor testers have been designed. But, they still require that they be used in the shop or lab. They may even be tested on an oscilloscope for performance to determine their operative ability or leakage condition.

The Multimeter Test Meter, Simpson or Triplet type, has become the technician's and serviceman's most handy and important tool for servicing on the spot today. This Simpson test meter made possible the fast checking of tube circuits and other electronic parts on the spot on complex systems and important electrical and electronic devices. Today this same meter is being used on the new state-of-the-art printed circuit cards, solid state circuitry, transistors, diodes, etc.

This "adapter/conversion board " makes possible the simple change over of a common test instrument (Simpson or Triplet), into a transistor tester for on the spot testing of normal defects of transistors, diodes, or other solid state devices.

Using the standard Simpson 260 meter, a printed circuit card adapter, with a circuit for testing general type NPN and PNP transistors and solid state components for defects, is "piggy-back – plugged-in" over the existing controls on the meter. The settings are then set to 50μA and dc on the meter controls. This results in now having a full transistor tester with new controls on the printed circuit adapter.

Connect the PC board to the meter by way of the mounting banana male studs. This makes the necessary connection to the Simpson 50 microammeter direct. Add the

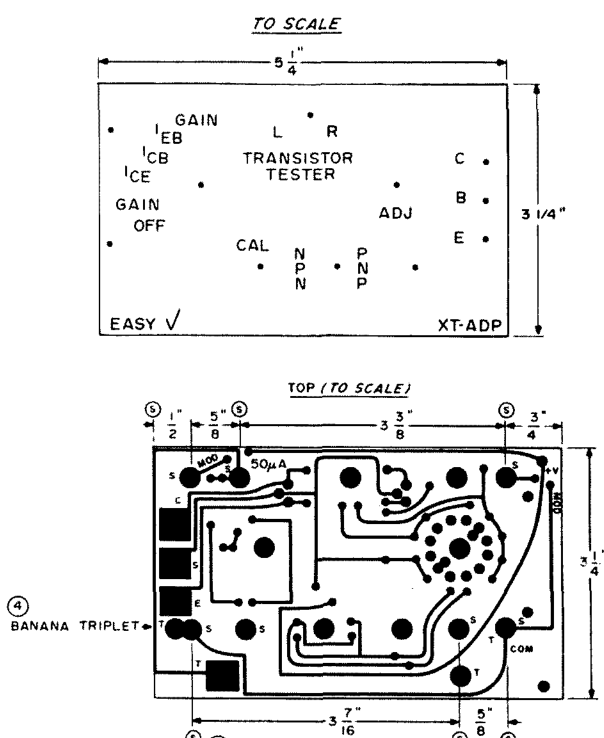


Fig. 1.

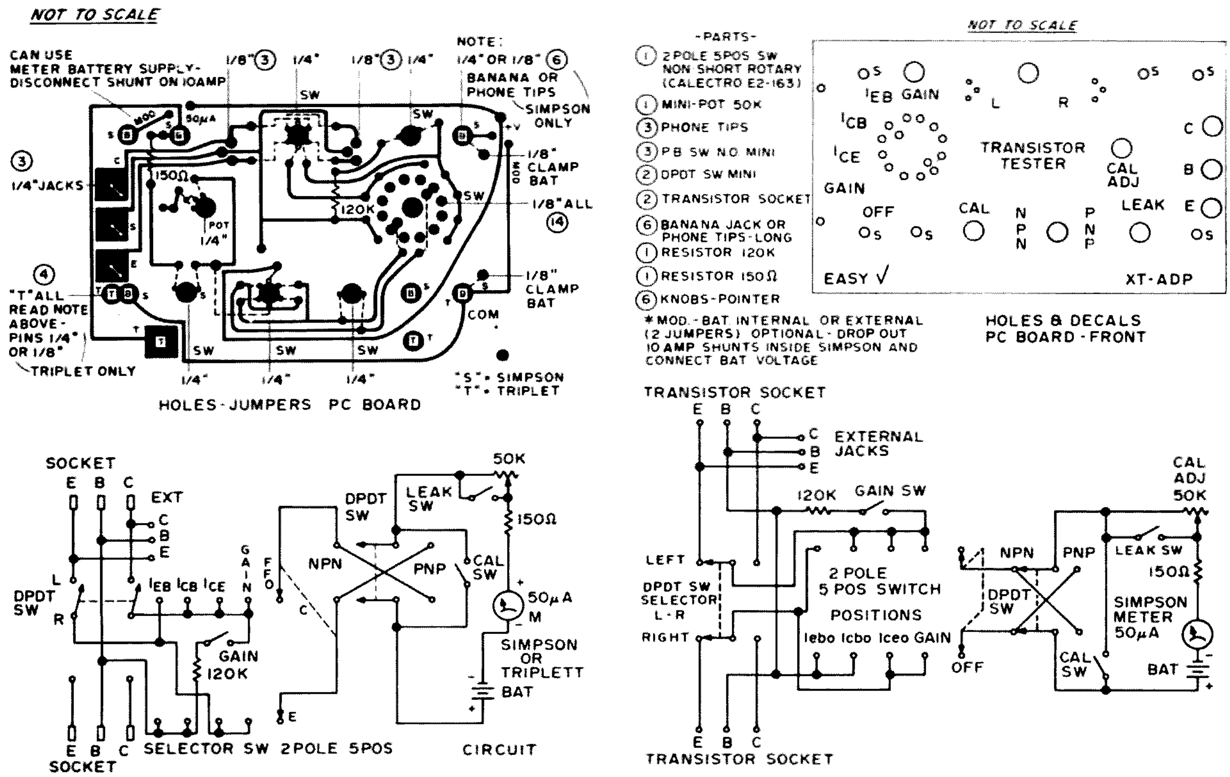


Fig. 2. Transistor adapter circuit for Simpson 260.

clip-on battery, to complete the conversion of the multi-meter to a transistor tester. The controls on the adapter enable the operator to adjust the 50 microammeter for full scale. Or, scale 1.

This full scale of 1 can be used for the gain measurement of dc or alpha, which is less than unity. By using the selector switch on the adapter board, you can check the dc gain – Iceo, -Icbo, Iebo, – the last three being diode action, reverse current and action test for front-back leakage. This takes care of the leakage currents in the base, emitter and collector, and makes a quick gain check on the tested transistor.

For diodes, external pin connections "C and E" and left position on the selector, make this check possible. Transistor comparison testing is made possible with the "L and R" selector switch. Leakage switch is used to make the 50 microammeter more sensitive for lower leakage readings.

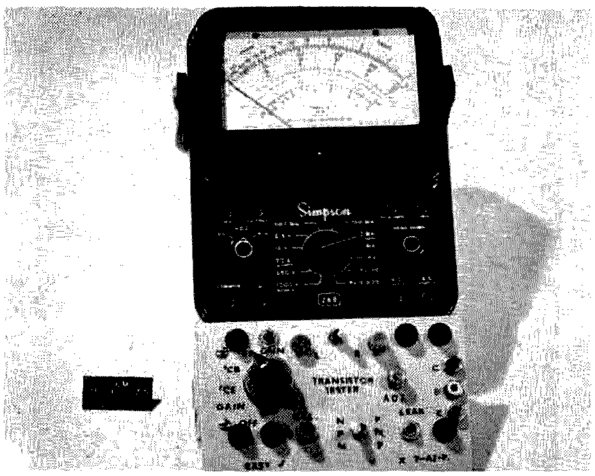
This tester adapter can be hand wired on a small board and adapted to other meters. This PC board has been designed for either the Simpson 260 or 270 and the Triplet 630 series. Mounting and drilling holes for the two types are marked as "S" and "T" on the PC etching. The board is called "EASY XT-ADP."

PARTS LIST

No. Name Description

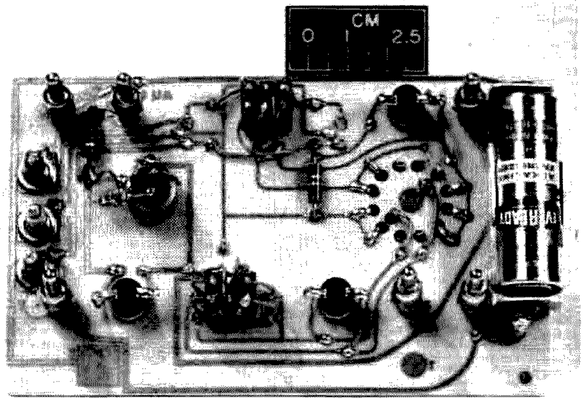
1 Switch – 2 pole-5 pos. wafer type 3/4" diameter non-shorting (calectro EE-163) or equal.
1 Adj. pot – 1/4" mount – 1/2" diameter case 50k (IRC).
3 P.B.SW. – Mini-type, N.O. contacts -1/4" mount (ALCO).
2 DPDT SW. – 1/4" mount (ALCO -MST 215) or equal.

More



Unmounted view.

2 Sockets – transistor chassis mount type – any type.
2 Resistor – 150 Ohm & 120k 1/4 Watt.
3 Phono jacks – chassis mount – 1/4" type (external).
1 Bat. clip – (Keystone Enterprises) single #139.



PC board.

6 Banana plugs – male test type plug – 1/8" or 1/4" mount. (Note: May take apart a test lead-male plug and use tip, or banana.)
1 Battery – (Eveready type #523) or equal.
Misc. decals, 4-40 & 6-32 nuts and bolts, etc.

. . .W8WLM

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Easy BFO Project for All Wave Receivers

There are many good quality solid state general coverage receivers available to the new amateur. One of the best and most economical is the Radio Shack DX 150B. However, at $136.95 it is expensive enough to strain the budget of the beginning ham. This article describes a project for adding a bfo and crystal filter to an inexpensive Knight Kit four tube superhet receiver which could be easily adapted to any receiver.

My receiver has a system for introducing feedback in the last i-f stage. The suppressor grid is grounded through a switch and variable resistor; the amount of feedback is variable and causes the stage to squeal when a signal is being received. Mine never worked very well because when enough feedback was introduced to make the stage oscillate it would take off and begin to motorboat all the time – and was thus useless for copying CW. I used the receiver for a while as best I could, but as soon as the budget would stand it I bought a Heathkit HR 10 B receiver. No one seemed interested in buying my Knight

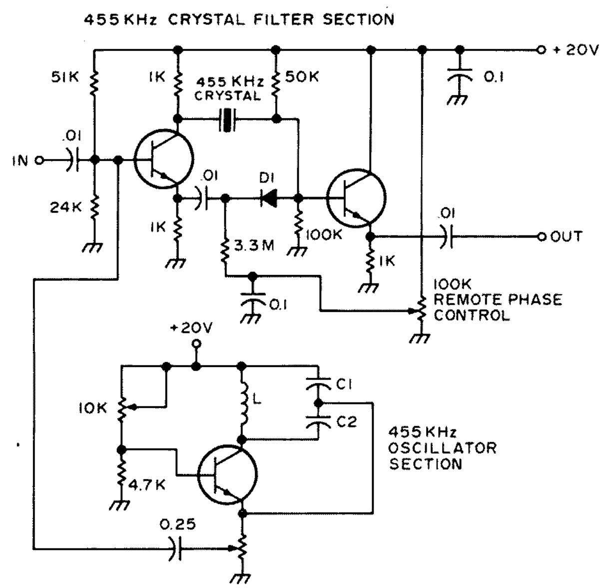


Fig. 1. (From pages 13A and 16A, 73, March, 1967) Values shown are for 455 kHz i-f section. To utilize this circuit for other i-f frequencies, refer to above pages and obtain crystal for your i-f frequency.

Kit Star Roamer so I let it knock around the shack for 7 or 8 years, leaving it tuned to the standard broadcast band or occasionally tuning in Radio Moscow or BBC.

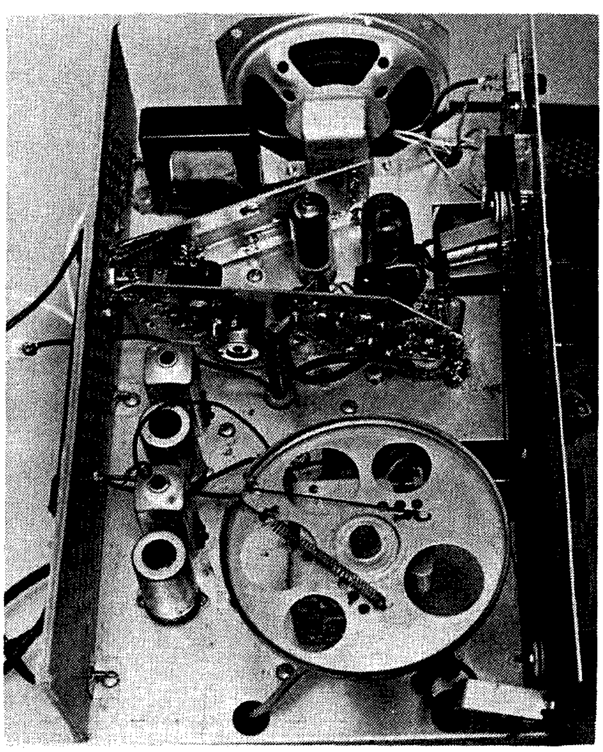
Some time ago I read an article about copying commercial telegraph stations for code practice. As my rig is now a Heathkit SB 102, it has little overlap at the band edges (and this is not where the commercial telegraph stations are). As I aspire to replace the Bendix MRT 6 on two meters with one of those new solid state jobs, there is not enough money in the old sock to cover the expense of a new general coverage receiver. As the Knight Kit has been knocking around gathering dust, I decided to see if it would be possible to upgrade it to an acceptable level for CW copy.

After casting about for circuits to use for the bfo, I came across the book bonus section in the March 1967 issue of 73 Magazine, *73 Useful Transistor Circuits* by W1DTY. The circuit board consists of two sections: the bfo section on the right and a single crystal 455 kHz filter on the left. Both circuits are from the same article and the book is still available from 73 Magazine for a mere dollar.

The bfo is simple in theory and is no problem to get working. Solder the parts in and tune bias control until oscillation is heard in the speaker of your receiver. Turn volume up and if the signal is not heard in the receiver run a short lead to the i-f strip and tune for maximum. However, I was able to hear the signal loud and strong without much fuss and bother.

I intended from the start to use the voltage tripler shown in the accompanying photographs for my power source; however, for experimenting and just getting the bfo working I snap two #1602 Eveready 9V transistor batteries together as shown to get the voltage necessary. This works fine and can be used for a quick and simple 18V source for all sorts of breadboarding.

The 0.5 coupling capacitor proved to be too large for my unit so I went to the 0.25 μF shown. The transistor used in my original version of the bfo was an RCA SK 3011. A variety of transistors were tried in the circuit including SC 3011, SK 3019 and Motorola HEP 50. All worked well. The SK 3011, being a germanium where the others are silicon, made the use of 12 and 20V sources necessary. No problem though, I mentioned



Top view of chassis. Lower circuit board is oscillator and crystal filter. Upper board (next to speaker) is voltage tripler. Shown from foil side of the board. Large circular disc at left on bottom board is base bias control pot for the 455 kHz oscillator. Photos courtesy of W4PED.

it just in case different transistors are selected. Be sure the voltage is correct: you can blow a transistor with improper voltages and polarity. I decided on the use of all Motorola HEP 50's because they are inexpensive (79¢ each). Shopping around would probably cut the price somewhat but they are readily available at any parts house handling Motorola equipment.

The output level is critical on the bfo so base bias and output level must be adjusted to give proper peak to peak voltage. This circuit put out 10V peak to peak with the SK 3011 installed. This will overdrive the stage and cause loss of signal, pulling and distortion. For this application we found the voltage to be around 4.5V peak to peak.

In feeding the bfo signal into the receiver I tried several different places and all seemed to be acceptable with proper adjustment; however, I went to the circuit board shown because it was much easier to feed the signal into the circuit board, making it unnecessary to run another wire to the i-f section.

The Filter

In deciding on a suitable filter system, several circuits were tried. Most involved tuned circuits, which tend to get rather complicated. At about this time I received a flier in the mail from Jan Crystals, Fort Myers, Florida. They had 455 kHz crystals for $1.75. I had already noted the single crystal circuit in the 73 transistor circuits manual using a varicap diode for the crystal phasing control which gives remote tuning. The control can be put on the front panel and the varactor diode mounted on the

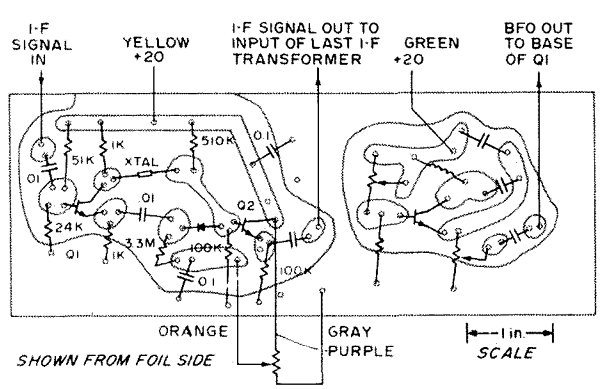


Fig. 2. Oscillator-filter circuit. Q1 – 2N2925 or 2N3392; Q2 – 2N3478, 2N3564, 2N3707, 40236, or HEP 50; D1 (20 pF) – 1N954 or TRW V20.

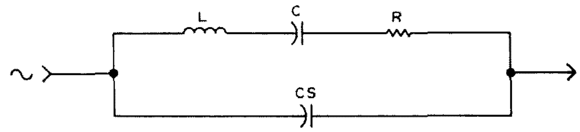


Fig. 3. Equivalent circuit of single crystal filter.

circuit board, making remote tuning possible.

The single crystal filter can be made as narrow as 50 Hz if properly isolated. This is possible due to the very high Q of the crystal. This very narrow bandwidth presents some problems. As this project utilizes a $39.95 receiver, the local oscillator is not the most stable and the receiver will drift a bit. Even with a voltage regulator the problem is not entirely eliminated as temperature sensitive components throughout, together with the mechanical instability due to the length of the frequency sensitive wiring of the bandswitch, make it difficult to correct entirely.

How It Works

To understand the operation of the single crystal filter, it is assumed that a parallel resonant circuit exists, formed by the crystal LCR on the one leg, and the shunt capacitance, represented by the holder and associated wiring, on the other. Though small by comparison, this shunt capacitance CS is many times the capacitance of the crystal and must be balanced out to prevent unwanted signals from being bypassed around the crystal. This is done by taking a signal which is of the proper phase and passing it around to the output side of the crystal, thus effectively cancelling the signal which was passed by the holder CS.

Various circuits have evolved which change the selectivity of the circuits chosen; however, as I wanted to avoid complicated tuned circuits necessary to make the selectivity variable, I stuck with the basic circuit.

As varicap diodes are really simple to work with but difficult to explain without getting into depletion regions and the like, any explanation short of major theory will have to be an oversimplification. In any

event, minimum capacitance occurs with maximum reverse bias roughly equivalent to plates open or unmeshed, and maximum capacitance, plates meshed, at some value approaching zero. The exact voltage varies from type to type and from manufacturer to manufacturer. Some value of capacitance is taken at a given amount of reverse bias, usually around 4 to 4.5 V, and used as a reference point. The capacitance value is not linear, i.e. a given uniformly changing reverse bias voltage does not cause a corresponding change of capacitance at a uniform rate. Due to this non-linearity of the tuning rate of varicap diodes and the wide variation of capacitance which will have to be neutralized, maximum selectivity will be difficult to predict. Jt will not necessarily fall at the point where the phasing control shows maximum. It is not like a volume control but rather is a neutralizing capacitor and thus maximum selectivity will occur at that point where the capacity of the holder and associated wiring is exactly neutralized, allowing no signal to pass except that which goes through the crystal.

The filter is removed by finding the point at which maximum by-passing occurs. This is the point of broadest bandpass. The bandpass can be made quite narrow and this filter has a tendency to ring at maximum selectivity on the strong signals, a really weird signal sound and very difficult to copy. When ringing occurs, back off on the control until it stops. The stronger the signal the more ringing.

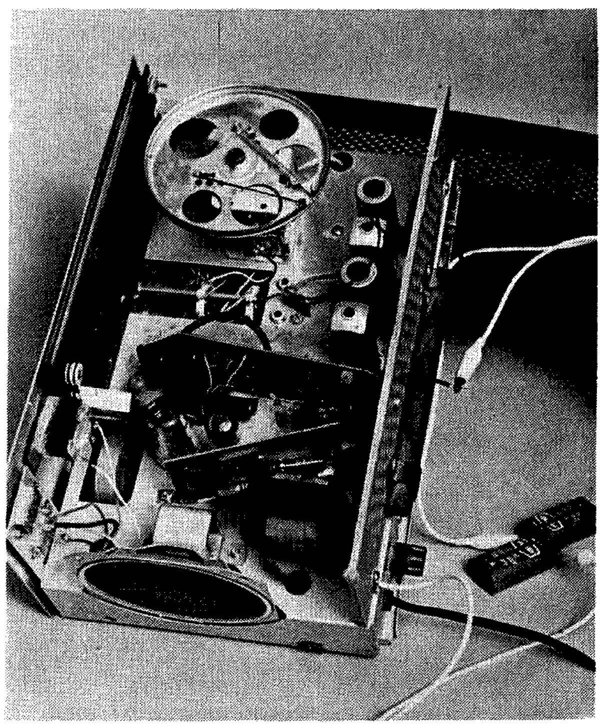
This may not be the ideal solution, but for \$7.00 worth of parts and a little help from the junkbox we have a general coverage receiver which does the job and gives adequate performance on the Maritime Service bands.

The filter will effectively cut down on the gain of the receiver. This is the reason transister amplifier stages are added. The circuit loss of the filter must be overcome.

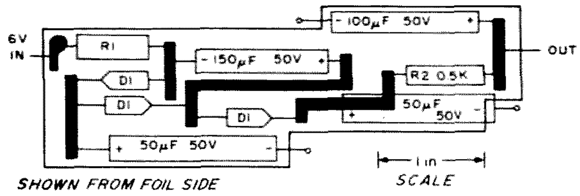
Some Notes on Construction

Use miniature coaxial cable for all rf connections, remembering to ground the coax at one end only to avoid ground loops. The bfo was fed to the circuit board filter section as it was necessary to minimize the number of connections to the i-f section (because any point where the signal is intercepted could introduce enough voltage to bypass the crystal). These points are kept at a minimum by injecting the bfo as shown. Use only as much bfo signal as is needed to give comfortable copy, as too much bfo will distort the signal.

I tried three different power sources. The first consists of two 9 V batteries. While this is the simplest, it is also the most expensive. To get some idea of battery life in this application, I monitored the battery current drain for some 4 hours and found it to be just under 20mA at 18 V. This gives adequate volume for comfortable CW copy. As I usually copy CW with headphones this gives less battery drain. I paid \$1.07 for two Eveready 9 V batteries at a local discount drug store and with an anticipated battery life of about 30 hours this definitely is not the best way to go. Besides, it is necessary to disconnect the batteries each time the receiver is turned off. One night I turned the power off and left the batteries connected



Chassis top from component side of circuit boards. Voltage tripler power supply is at the bottom. 455 kHz oscillator and crystal filter are at center. Note 9 volt batteries. When used as an alternate power source, snap together as shown for 18 volts.



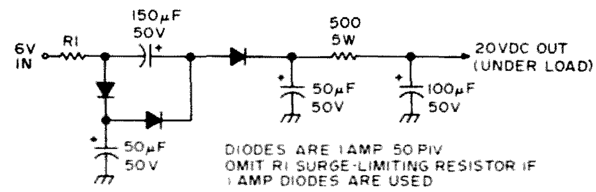


Fig. 4. Voltage tripler.

overnight – and allowed a set of batteries to drain.

The diodes are Radio Shack, two for 29¢, part number 276-1135 one Amp at 50 piv. The voltage tripler is straight out of the handbook and is taken from the 6 V filament winding. Capacitors are 150 μF at 50 volts, 100 μF at 50 volts, and two 50 μF at 50 volts. The 150 and 100 μF came from the junkbox. The 50 μF capacitors came from a local wholesale house at 77¢ each. The total cost of the project was less than ten dollars, including the crystal. My decision to use the voltage tripler was based on the need for as much stability as possible. The most obvious source of B plus for the circuit boards was the use of a dropping resistor with a zener diode. This tended to fluctuate with the line voltage and had a weird effect on the signal. Obviously, this is the most inexpensive way to go, but in my circuit, it tends to contribute to the instability of the set.

This circuit will work in any of the older tube type receivers which do not have a bfo. If you want to increase the selectivity of your receiver for more comfortable CW copy, while at the same time retaining the standard broadcast capability, I recommend it highly. Further, if an i-f frequency of other than 455 kHz is desired it may increase the price slightly due to the necessity of using a special rather than a surplus crystal. I also soldered the crystal directly to the foil side of the board to avoid the use of a crystal holder, which increases the capacitance and must also be neutralized.

...WB4KTY

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How to put on a Professional Slide Show

With A Slide Synchronizer

And this is a shot of me by the White House, (click) and here's the wife in front of the White House, (click) this is the White House without any of us in the picture. . ." Is this how your slide shows go? Dull, monotonous, with a tendency to put people to sleep? Just the thing to perk up your presentations, our S&TS Slide and Tape Synchronizer is a snap to build and will let you breathe some life into your slides.

The S&TS allows you to record a soundtrack on any stereo recorder, using one track for audio and the other tracks for tones that are demodulated and converted to a signal which activates the change mechanism of your slide projector, using the existing remote control. It can be built in an evening, uses readily available parts, and costs far less than commercial units.

The first step in building the S&TS is to determine the switching arrangement of your remote control. Measure the resistance from pin to pin on the remote control while operating the forward, backward, and focus, if any, button. Of course, do this with the control disconnected from the projector. A circuit diagram of the Honeywell 630 control is shown on the right of Fig. 1. As can be seen, the basic switch is a normally open SPST, with a DPDT switch for forward–reverse slide direction. If this projector were equipped with remote focus, additional switching would be included.

Armed with the specifications of the control, the circuit shown on the left of Fig. 1 was constructed. A relay acts as the slide change switch, with the regular remote push button for manual override. Connection is made to the projector through the remote control connector. The 5-pin connector used in the Honeywell is a standard configuration which is available widely. Similar connectors are used on other equipment.

The audio signal for the unit may be generated in many ways. The most elegant

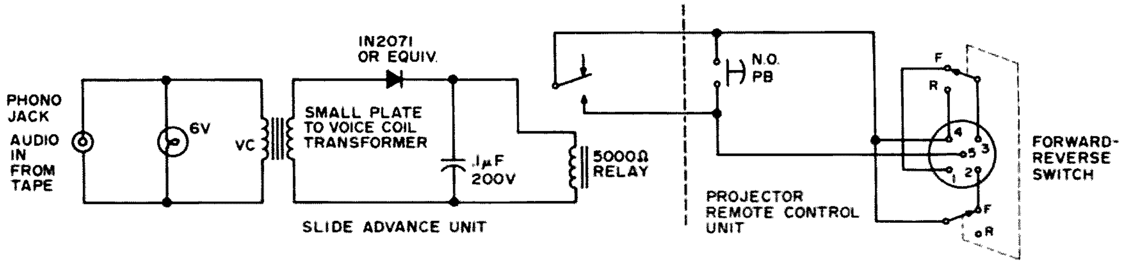


Fig. 1. Schematic.

would be an audio oscillator, of the type often used for ham code practice, included in the unit. But this would increase the size, cost, and complexity needlessly. A much easier solution is to use any audio generator around the shop, with the cheapest, easiest and most available being a whistle or vocal "beep" into a mike. An exact frequency is not critical, so long as it is above 1 kHz or so to permit adequate smoothing by the filter capacitor. If lower tones are desired, a larger capacitor should be used.

Construction technique is up to you. The method I used was point to point wiring in a small plastic box. Parts may be scrounged from the junk box, but if bought all new they should run under $10. Frequency selective R/C circuits with hi-lo tones may be used to feed two relays for full forward-backward control, if you want to get really fancy.

The pilot light across the audio input is included so that tapes may be reviewed and slide changes noted without having to listen to the tones or run the projector. It may be omitted if it is not desired.

Now a word on program production. The thing you want least to do is record a monologue and play it straight. Arrange your slides in a logical sequence, which may or may not be the order in which they were taken. Get rid of slides that show nothing, or are duplicates of others. Comment *about* the slide, don't *describe* it. Give interesting background material. Lead into a slide by talking about it before and while the slides are changing. Use nondescript but otherwise attractive slides as spacers between slides in your story line, to be shown without comment. And finally, appropriate background music may be used with voice-over to complete the continuity of the show. If your collection does not include such music, suitable selections may often be found in the public library or in friends' collections.

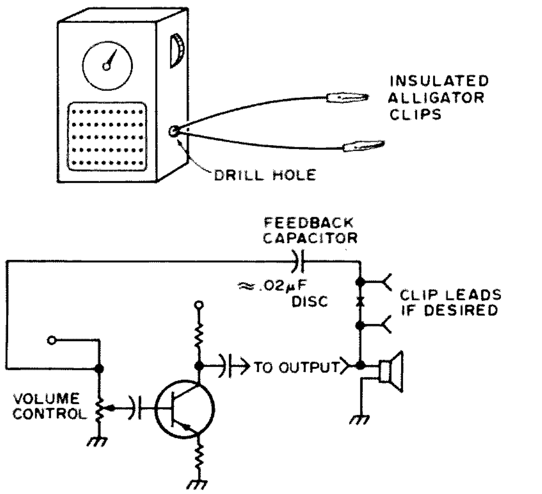
To use the S&TS, first assemble your slides in a logical sequence, and write either notes or a full script. Select the music to be used for background. Record the script and music onto one track. Then go back and, while listening to the script, record the slide change tones on the other track. Connect the speaker output of the tape track with the tones to the sync unit and the S&TS output to your slide projector, making sure the direction is on forward. Turn out the lights, turn on the projector and tape recorder, and enjoy a truly professional quality tape-slide show.

. . .WA3AJR

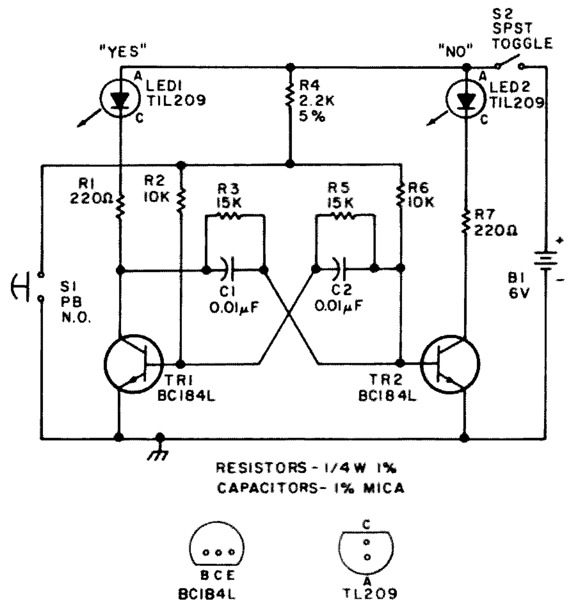
CIRCUITS, CIRCUITS, CIRCUITS. . .

The following circuits have appeared in reference books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

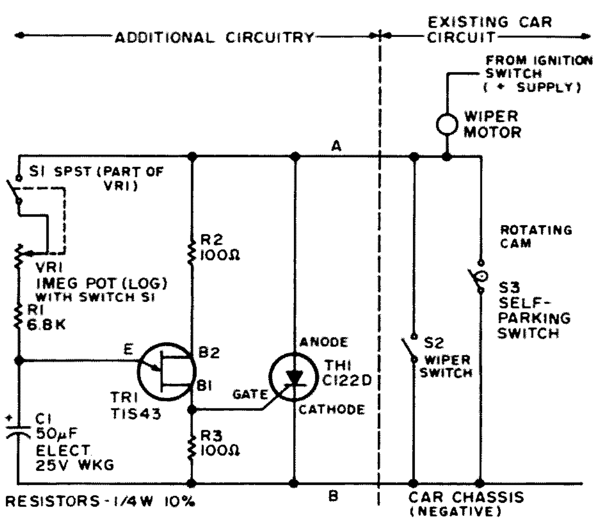
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.



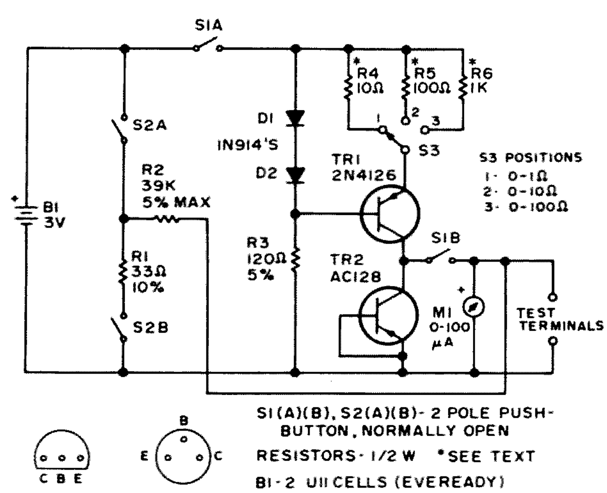
Code osc or continuity tester from a transistor radio. Add a .02 μF from the high side of the vol control to the speaker. If this fails, pick a spot in the output section that gives feedback. Thanks WB2IGR.



Electronic coin tosser. Complete project is in June 74 issue of Radio & Electronics Constructor. Circuit will give random result if zero volts on test between lower end of R1 and R7.



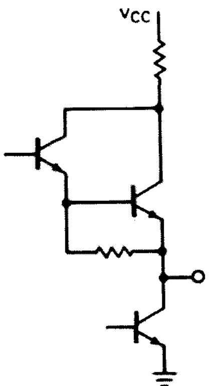
Windshield wiper delay circuit for negative ground cars. For positive ground systems merely put the wiper motor in the positive lead of the circuit. Complete project is in Radio & Electronics Constructor for July 1974, 57 Maiden Vale, London W91SN, England. Subs are $7/year. Circuit will allow double wiper sweeps at intervals of from a half second to a minute and a half – great for fog, mist, stuff like that.



Low value linear ohm meter (down to .05 ohms). Project is from July 1974 Radio & Electronics Constructor.

TTL OUTPUT CONFIGURATIONS

a. DARLINGTON



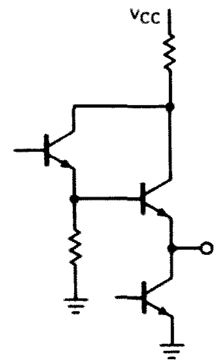
ADVANTAGE:

High ac drive capability
$V_{OH} = V_{CC} - V_{BE}$ at $I_O = 0$
Small size (transistors share one common isolation)

DISADVANTAGE:

Output cannot be pulled higher than one diode drop above V_{CC}

c. DARLINGTON WITH RESISTOR TO GROUND



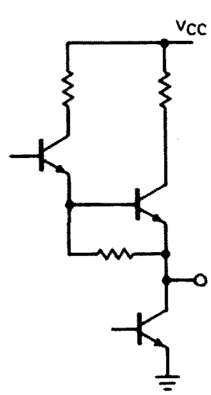
ADVANTAGE:

High ac drive capability
Lower $V_{OH} = (V_{CC} - 2\ V_{BE})$ increases speed
Outputs can be pulled higher than V_{CC}

DISADVANTAGE:

Higher dissipation
Lower noise immunity in the High state

b. 2-STAGE EMITTER FOLLOWER ("DARLINGTON SPLIT")



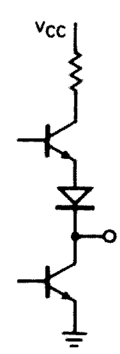
ADVANTAGE:

High ac drive capability
$V_{OH} = V_{CC} - V_{BE}$ at $I_O = 0$

DISADVANTAGE:

Larger than circuit A
Output cannot be pulled higher than one diode drop above V_{CC}

d. TRANSISTOR — DIODE



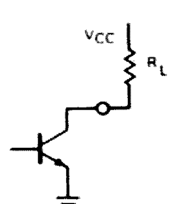
ADVANTAGE:

Lowest power consumption
Small size
Outputs can be pulled higher than V_{CC}

DISADVANTAGE:

Less ac drive capability

e. OPEN COLLECTOR



ADVANTAGE:

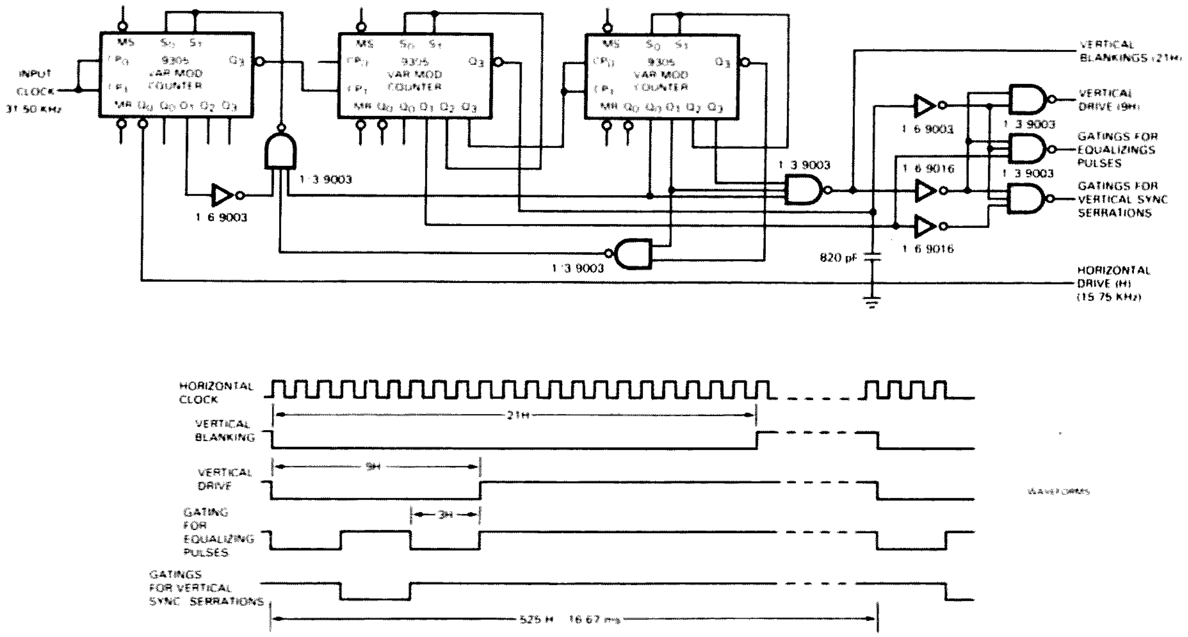
Bussable, allows collector ANDing (Wired-OR)

DISADVANTAGE:

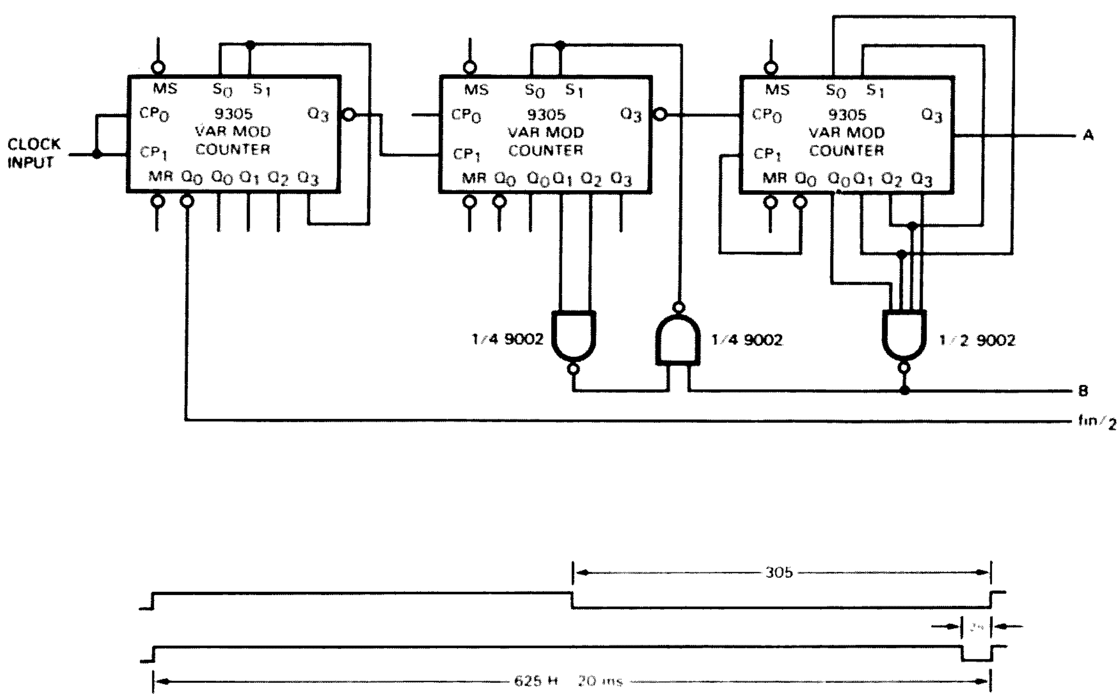
High output impedance in the High state
Slow, especially with capacitive loading
Requires additional resistor

BASIC TV SYNC GENERATORS

MODULO 525

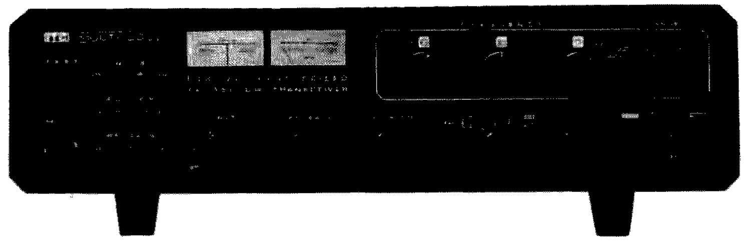


MODULO 625



Two basic TV sync generators are illustrated above. The 525 divider produces waveforms basic to the American EIA standard and the waveforms of the modulo 625 divier are the primary timing waveforms. By gating the waveforms shown with appropriate equalizing, vertical serration and blanking signals, standard sync waveforms can be generated.

NEW PRODUCTS



ITC MULTI-2000

Synthesized FM, sideband and CW, all in one little rig! The Multi-2000 is an amazing package, and sells for not much more than an ordinary synthesized two meter FM rig: $695.

The FM part first. The 2000 has a fully synthesized circuit and covers the entire two meter band, from 144-148 MHz. It switches in 1 MHz, 100 kHz and 10 kHz segments, with a +/- 7 kHz offset pot so you can get on any frequency you want. This means you can work any 30 kHz channel repeater or even the 15 kHz splinter channels. It will even permit you to zero in on oddball repeaters such as the Boston 146.39-99 machine.

The channel switch permits you to operate simplex – sending and receiving on the same channel – or duplex, transmitting either 600 kHz up or down from the received channel. There are also four crystal controlled channels available, if you want to use them. If you want to work with a repeater with other than 600 kHz split there is simple mod for the 2000 to meet this emergency, too.

There are two meters on the unit – an S-meter and a discriminator meter which indicates frequency deviation. Using the RIT control you can zero an off channel repeater without having your own transmitter off frequency. Most synthesized rigs send and receive 600 kHz apart and are locked into this.

The 2000 puts out about 12 Watts in the high power position (rated at 10 W) and about one Watt in low power.

Touchtone? Plugs right into the handy accessory socket in the back.

Quality reports on the speech have been universally excellent – it is clean, crisp, sounds great – and has good punch due to speech processing.

Sideband

In addition to all that FM up there between 146-148 MHz, there is a lot of sideband excitement going on in the lower reaches of the band. If you have any interest whatever in DX you need sideband. All aurora work is by sideband or CW – and most real long distance work is by sideband and CW.

All this brings us to Oscar – if you haven't listened in to Oscar yet you are hiding your head in the sand. Oscar is fantastic – both Oscars are fantastic. More and more of the Multi-2000s are being used to work through Oscar from 145.95 MHz to 29.5 MHz. You can do it barefoot! Some fellows are up over 20 states and several countries with these rigs barefoot through the Oscars. The rig is well worth the price for that application alone.

When Oscar 7 goes by you can tune it in with the 2000 and hear all those fellows having a ball. You tune from 145.925 to 145.975 – the 50 kHz is spread out in 10 kHz segments on the 2000 so there is no problem separating everyone. The Oscar 7 signals come in on lower sideband, so you need a mod on the 2000 to copy them, the rig being set for upper sideband work. This calls for a change of the sideband selecting crystal inside (takes a moment). If you want to have switchable sidebands you add a toggle switch, the crystal and a couple of switching diodes. Oscar 6 and 7 require upper sideband input to work through to 29.5 MHz, so that is all set to go as is.

On sideband and CW operation the noise blanker circuit is available – and that is a state of the art invention which works like magic.

The 2000 is exceptionally well built – as a matter of fact the insides were used as the background for the picture of Judy Repeater on the cover of the April FM issue of 73. It is built in Japan, where the rig has been very popular. Since there are more Japanese two meter amateurs than there are in the U.S., the large volume of units being made has kept the price down substantially – so we are benefitting directly from the fantastic expansion of amateur radio in that country.

The importer sent along some specifications which seem reasonable. Sensitivity 0.2 uV for 12 dB Sinad – 1.0 uV for 20 dB quieting. Desense at 100 kHz greater than 135 dB. SSB sensitivity 0.12 uV for 10 dB S/N. Intermods more than 72 dB down for 3rd order Intermod products. Stability better than 10 Hz drift after 2 minute warmup. I-f of 16.9 MHz.

The 73 Mountain was snowed in, so tests of the 2000 in a high rf atmosphere had to be made in the Boston rf pollution by Tufts Radio entrepreneur Chuck Martin in Medford. Chuck, who runs a split channel repeater, is all too familiar with the deficiencies of virtually all FM rigs as far as adjacent channel signals are concerned. He claims that in the month he's used the Multi-2000 he hasn't heard one spillover from the other repeaters! And he says the 2000 is the best he's every used for sharpness of the i-f. After a couple days with the 2000, he got so many local amateurs interested that he opened an account with International Telecommunications and ordered several 2000s for his customers.

In addition to the outstanding performance on FM, Chuck has been doing a lot of mobile sideband work, getting remarkable ground wave ranges with it. There apparently is a re-awakening interest in two meter sideband and in two meter DXing. Chuck claims that more and more fellows are coming on sideband every week in the greater Boston area and many are able to easily make contacts out over 100 miles, with some out to 200 miles.

73 and Hotline will be interested in reports of sideband occupation of 2m in other parts of the country.

The Multi-2000 is a good step ahead – a fine FM rig – a good sideband rig – and a needed link for satellite work.

CHRONEX WATCHES

A couple of years ago I sent my Rolex watch in to the company office in New York for cleaning. It disappeared.

That was a blow. I'd become used to having a watch which would go anywhere with me and provide accurate time. Jean Sheppard K2ORS had gotten the watch for me in Ireland back around 1956.

Once the insurance money was in hand I decided to get a digital electronic watch . . . the question was,

which one? After looking over the field carefully, it came down to one watch which seemed to be really state of the art – the Chronex. Not only did this one tell time, it also read out the seconds and gave the day of the month and month. Better than that, it even had compensation built in to handle the varying length months – even February (except leap year . . . you have to correct for that one once every four years).

The fact is that you get used to a LED readout watch very quickly. The numbers are bright enough to read easily even while skiing on a dazzling sunny day – the watch is a snap to set . . . a little recessed switch which can be activated with a ball point pen allows you to set the functions. One push of either of the two switches on the side of the watch causes it to flash the time for about two seconds. If you hold in the switch, the hours and minutes will disappear and you will see the seconds reading off. Two pushes of either switch will flash on the month and day.

I understand that the chap who designed the Chronex is the same one who came up with the older Pulsar watch – Pulsar had better watch out. Heh.

In addition to a certain smugness at always knowing the time right down to the second (which has little value other than getting me to the few TV programs I watch on the split second), the watch is a great talking point in explaining the changes that have taken place in electronics in the last few years. I point out that such a device would have taken a six foot rack of equipment just a few years ago . . . now there are about 1500 transistors in the one little chip in the watch . . . the whole circuit being about 1/8-inch square!

Alert readers may have noticed that Chronex is advertising their watches in 73 – with a special price for 73

readers – the jeweler wholesale price – about 50% of the regular retail price! Chronex, 418 S. Yale, Garland TX 75042.

. . . W2NSD/1

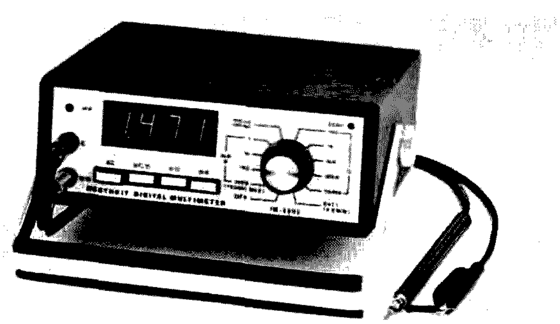
GOING FIRST CLASS: THE CURTIS IK-440

Here is a combination first class keyer and code practice unit which should be of particular interest to any amateur who is enough into helping others get their tickets to provide code practice.

The keyer unit, which sells for $125 alone, has self-completing dots, dashes and spaces, sidetone, perfect dot memory and variable element weighting.

The code generator provides random code from four to fifty words per minute, with a selector for either just letters or letters/numbers/punctuation – fantastic for code practice. Amateurs or clubs providing code practice classes or on the air code practice will find this gadget most helpful. The price is only $225!

Write Curtis Electro Devices, Box 4090, Mountain View CA 94040 for more data. See it at your local distributor.



NEW HEATHKIT PORTABLE DIGITAL MULTIMETER

The new IM-2202 Portable Digital Multimeter is the lowest-priced professional-grade digital multimeter Heath has ever offered. It's truly portable – included in the unit are four rechargeable nickel-cadmium batteries and a built-in charging circuit. Up to eight hours of continuous operation can be obtained from each charge.

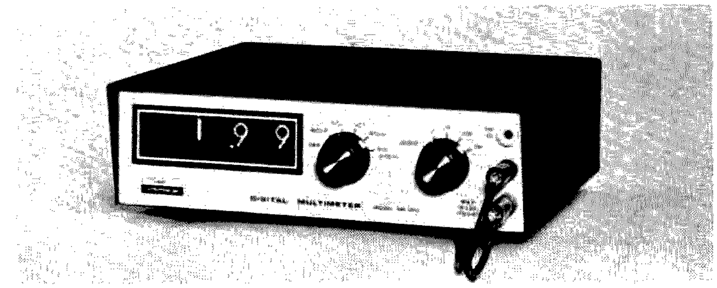
Its 26 ranges include full scale ranges of 100 mV to 1000 volts dc, 100 mV to 750 volts ac, 100 uA to 1000 mA and 100 Ohms to 1000 kilohms. The 100% overrange capability allows measurements up to 1.999 on all ranges except 1000 V dc and 750 V ac, giving full 2 Amp or 2 megohm capability. Overrange condition is automatically indicated by a flashing "1" display.

If a lab standard is used for calibration, dc accuracy is ±0.2%. For ac, accuracy with a lab standard is ±0.5% to 10 kHz. Internal standards supplied with the kit allow easy field calibration to ±0.5% for dc and ±1% for ac.

The large 3½-digit display features automatic polarity indication and decimal point placement. A continuous-rotation range switch and four push-button function switches select any of the measurement ranges.

Assembly of the IM-2202 is aided by circuit board construction and "plug-in" components. Mail order price is $179.95, F.O.B. factory. For more information, contact Heath Company, Benton Harbor MI 49022.

NEW PRODUCTS

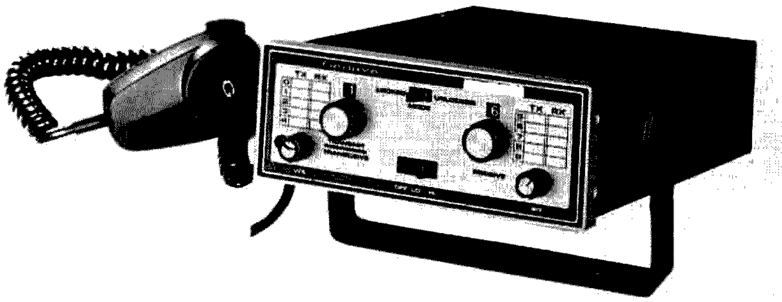


HEATH MULTIMETER

The new Heath SM-1212 Digital Multimeter includes ac measurements up to 700 volts. Four overlapping ac and dc ranges make operation fast and simple. And it's hard to find better accuracy for less money: 1% on dc volts, 1½% on ac volts and ac/dc current, and 2% on resistance.

It's simple to operate, and the large 2½-digit display with automatic decimal positioning ends "reading the wrong scale" errors. Lighted front panel indicators show overrange, + and - dc voltages and current at a glance. The built-in calibration standards are all that is needed for periodic adjustments.

Mail order price of the factory assembled and calibrated SM-1212 is $120.00, F.O.B. factory. For additional information, contact the Heath Company, Benton Harbor MI 49022.



THE GENAVE GTX-100 TRANSCEIVER

Genave has announced their 220 MHz transceiver – ten channels – ten Watts – with some interesting features such as a high-low power switch, a little gadget that makes it possible to rig the unit up as a walkie-talkie with a small portable power pack. They also have a switch which disconnects the receive crystal switch from the transmit crystal switch, allowing you to leave the transmitter on any of the ten channels while you put the receiver on any other of the ten channels. Under normal usage the two switches are connected together so they switch simultaneously.

The rig is designed to fit easily into your car – the front panel is only 6-1/2" x 2-1/2" and it is 9" deep. The mounting bracket has a provision for a padlock to make theft of the unit difficult. This is a very good feature these days when the 73 Hamburglar column is getting almost daily inputs on stolen ham equipment.

The GTX-100 is built on a single circuit board – a feature which greatly simplifies any servicing that you may want to do – and makes the addition of accessories quite simple. Genave had left plenty of room in the cabinet for such things as tone burst or continuous tone circuits if you like to modify your equipment. What a pleasure it is to work on a set like this after trying to follow wires around one of the rigs which has a bunch of circuit boards jammed together with cabling. Many amateurs like to do their own servicing, but if they can't even get at the circuits without major surgery they have to send it back to the factory.

The Genave instruction book is quite thorough. It not only gives you a complete schematic, but also shows the circuit board layout with schematics superimposed on it so you can see what parts are mounted where and what interconnections go where.

Hopefully the GTX-100 will help entice more amateurs to use the repeaters which are being set up all around the country on 220 MHz. Use it or lose it.

HIGHLY RECOMMENDED

A very interesting and readable catalog is available free from MFJ Enterprises. Listed are CW and SSB filters, electronic keyers, frequency standards, audio amps, active filters, PC boards, electronic components and many other items. The specs on the items are followed by suggestions of possible applications which read more like articles than ads. Available for the asking from MFJ Enterprises, P O Box 494, Mississippi State, MS 39762. Mention 73 when writing.

SNAP-IN TIP FOR CORDLESS SOLDERING IRONS

A new snap-in tip design is featured in all models of the new Iso-Tip Cordless Soldering Irons by Wahl Clipper Corporation. Previously, mounting screws had to be loosened and retightened to replace a tip. With the new design, the user simply inserts the tip and snaps it into place. No further locking is required, although the user still has the option of screw-tightening the tip if desired. Tips can also be easily snapped out for safer carrying in tool box, tube caddy, etc.

More information may be obtained from Wahl Clipper Corporation, Sterling, Illinois 61081.

TWO METER AMPLIFIER

Specialty Communications of San Diego has announced a 2m amplifier which is designed to work both class C for FM and CW, and AB linear for SSB or AM (AM?). Model SCS-2M10-70L puts out 70W with 10 in, 50W with 5 in, and about 15W with 1.5 in (like from HTs). The price is $120. For data write SCS, 4519 Narragansett Ave., San Diego CA 92107. In the works are a 25W amplifier, complete with battery, for HTs – a pair of 432 amplifiers which run 1W-10W and 10W-40W – 220 MHz amplifiers – and a 28/432 MHz transverter system! Watch out Oscar fans.

73 VS ARRL?

When 73 first started, one of the basics stated was that "we aren't mad at anyone." This is a fact today, just as it was fifteen years ago. Not being mad has not kept us from either complimenting or criticizing the League. The fact that we don't hate the ARRL does not mean that we are in love with it either . . . hopefully we have it in reasonable perspective.

The League, being made up of people, cannot be perfect — since people are never perfect. The League, in reality, is the people at HQ in Newington, for the 16 directors, who meet for a few hours once or twice a year, are effectively isolated from the running of the organization and have historically exerted little control over HQ. Their main influence could have been in the hiring and firing of people, but when there has been a change of management at HQ they have in every case promoted the next in line, regardless of his qualifications.

Since little ever appears in QST about HQ, and certainly nothing in any way critical, few members are able to have much perspective on the League. Most of the ham magazines have, through fear of the League, ignored it. The whole situation has encouraged many amateurs to build up a fantasy image of the ARRL as promoted in QST.

It is unfortunate that the League has decided to build their reputation on a mystique rather than on their accomplishments, for they have plenty to point to with pride. W1AW has helped tens of thousands of amateurs get their licenses. The ARRL traffic system is an important part of amateur radio. League contests and awards are world leaders. League comments filed with the FCC are usually very well done. ARRL publications have been a backbone of the hobby for over half a century. There are too many plus items to list . . . yet we find, despite all of this, an exceedingly thin-skinned HQ which seems to lose perspective of any criticism.

Many amateurs are upset over the lack of elections for officers of the League, feeling that the automatic appointment system does not make for the best talent in these key jobs — which have such a profound effect on our hobby. To these complainers I would suggest that they look around and try to find a system that works better. We have had U.S. presidents elected by the people, yet see what we've had! Nixon . . . Johnson . . . .! Do we have any evidence that general elections bring us better qualified people?

I suspect, if the 16 directors were to take their job seriously and go through a talent hunt for the best man they could find as manager of the ARRL, that amateur radio might become a hobby to be reckoned with. I think we would not only grow, but would do it without having to prostitute our entry requirements with a no-code ticket. I think we would be growing, filling up our many unused bands, and even getting more bands to work with.

A really good business manager running the League would modernize the publications, set up a national PR program, have a strong lobby in Washington, revamp the ARRL investments so they would stop losing money (they have over $1 million salted away in savings accounts and securities) and galvanize the thousands of ham clubs into programs for growth of the hobby.

Think about it for a moment — please — do you really think that it is the amateur rules that have failed us and resulted in the lack of growth of the hobby? Do you really believe that changing the rules to make it easier to get a ham ticket is the answer? Or do you suspect, as I do, that we would have plenty of growth if we had an organization enthusiastically encouraging clubs to get out there and get more hams?

One aspect of ARRL that has not worked out too well is the system of carrying news from the members to HQ via the directors. The more usual arrangement has been the reverse, which has been the result of the lack of communications between HQ and the directors. The few hours a year they have at directors meetings just aren't enough for meaningful contact with HQ . . . so directors find that they get form letters from HQ and pass along the material to their clubs, rather than getting input from members and passing it along to HQ.

Let me state once more — 73 is not anti-ARRL — I do not hate the ARRL (nor do I love it). I've been a member for 37 years, with a possible interruption of a few months during WWII when I was beyond the post office while on war patrol in a submarine. Having been an editor and publisher in the ham field for about 25 years, and having been pretty much on the inside during most of those years where I knew what was really going on, not just the scenario (to use Nixon's terms), I probably have fewer illusions than most amateurs about the League, the FCC and amateur radio in general.

Though I've tried to keep from venting my ingrained sarcasm at some of the things HQ has done, I haven't always succeeded. This has angered many ARRL lovers, which is too bad. Communications break down under these circumstances and nothing is gained.

I do believe that the hobby of amateur radio will be healthiest if all of us keep after the League to be positive — to do the best it can — and let HQ people know that we all do care what they do in Newington. I think that national politics has made it clear that if we don't exercise our right to have our say that we will lose it. If we don't all keep pressure on the fellows at HQ to do our bidding, they will be all too human and bow to the pressures they do feel . . . which may not be just what we want. It takes a lot of voices to outshout a manufacturer who is donating $25,000 to the League in return for something he wants . . . and this does happen.

When you hear people putting the League down, pin them down and try to find out exactly why . . . if they can explain it. When you hear people praising the League to the sky, find out about that, too. Let's aim toward being realistic about the ARRL . . . about the FCC . . . and even about 73. You need not be realistic about our very good friends down at CQ magazine, if you don't want to. Hi.

. . . Wayne

BIG REWARD

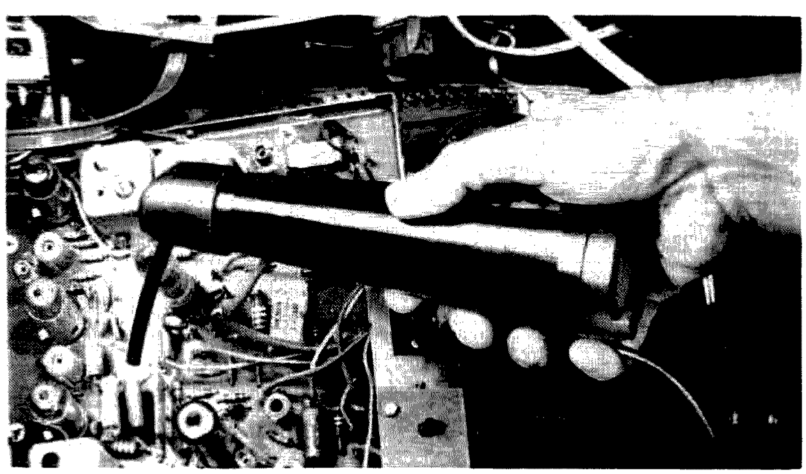
The big companies in amateur radio today were, for the most part, started by one or two amateurs . . . and many grew very rapidly as a result of the low ad rates in 73 and the wide circulation among active (buying) hams. We'll give you 10% of the first ad run by a new company if you let us know about them and they advertise first in 73. Do yourself and the new firm a big favor — drop a note to 73 Advertising, Peterborough NH 03458.

Voxpoop Voxpoop Voxpoop

Here are some comments received recently in the mail . . . Would like to see a Novice column, you would sell a few more magazines – K7GHZ. *(Let's see a lot of smaller articles for Novices – talk with them, find out what they need to know, then write it and make your hobby pay for itself . . . wayne.)* Loved your article on VOM design – would like more circuits[3] – more Novice antennas – keep after the IRS – WN9MXO. More on FM, mods for 2m FM gear – WB2IUD. How about more articles on RTTY? – WB6VFC. *(Yes! By all means let's have more RTTY articles.)* Wayne, for some reason, news and discussion of surplus gear fascinates many people, including myself. I'm sure someone could do a much better column than Gordon Elliot White. QST fails because it is an antique rag devoted entirely to the CW spark operator, which is the only mode they acknowledge. CQ is variable and the only time we hear from puppet Ross is when Cowan uses him to blast Wayne again – K6BB. *(Come on you surplus fiends, modify and write . . . publish or perish from the evil 73-Whammy which is aimed at all surplussers who are too lazy to write and become rich and famous. CQ? So who reads Congressional Quarterly? . . . wayne.)* Best ham magazine in the world – WA5TDF. *(Perceptive chap.)* More devices for around the shack, humor, 2m articles, antennas, operating practices – McMichael. How about a 5 kW linear for CB that can be pulsed to 50 kW so those XXX's can wipe each other out? And try to find part time jobs for FCCers who are thinking up new ways to put hams out of business – KL7HKQ. More SSTV and RTTY – WB9FLM. How about a technical staff to check accuracy of construction articles, schematics, etc.? You have the best ham publication on the market – W9BLR. *(You looking for work?)* Keep up the flow of construction projects and your circulation will soon surpoass QST – W4GBG. *(That's a deal!)* Very, very good . . . but more, MORE, M-O-R-E! Down with the other ham magazines – WB5FWE. *(Here, here!)* Generally great mag! – WB9ICR. *(Whaddya mean generally?)* Keep magazine as it is, leave the operating news to others, let them waste space – WØDL. *(Okay, you're probably right, Harry.)* Let's push 220 MHz, and give us some far out articles such as on gravity . . . look forward to the magazine every month – WB2IUT. *(Gravity? What's that?)* More technical articles on VHF and UHF – WB2YLI. More ads from dealers in used gear. With few in Texas and none in San Antonio, I depend on you for used gear info – Jarvis. *(How about it, dealers?)* More articles on log periodics for 2m, FM and the TV bands – LA1FP. *(Your March issue should have gotten to Norway by now – and we still have a lot more antenna articles up our sleeve!)* Liked everything in March, especially Ancient Aviator. Real good idea to have a good hard shot at antennas. How about power supplies next? – WN7AVK. *(We're working on it, Tom.)* Would like to see the following articles: 1) Simple self-calibrating deviation monitor for 2m FM; 2) How to make antenna field strength pattern measurements at 2m; 3) More electronics crossword puzzles, quizzes, and cartoons; 4) Tuning up, padding and improving various rigs like Motorola 41V, 43, GE TPL, etc.; 5) Mobile aids for keeping the old car running a little longer – troubleshooting – tune-ups – using the average ham's test equipment for special purposes; 6) A cross reference between magazines, such as for articles appearing in Electronics, Popular Electronics, etc.; 7) Touchtone usage relative to sequential logic circuits to provide various control outputs as long as proper sequence is fed in; 8) How to build a capacitive and/or inductive broadband rf sniffer with preamp; 9) A good battery powered VHF grid dip meter with a remote small sensing head able to get into small places, possibly using a varicap in the sensing head and a remote meter, battery and pot for adjusting frequency; 10) An assist to get ideas flowing, in the form of an outline showing antennas, xmtrs, rcvrs, SSTV, etc., as major topics, along with a list of minor sub-topics, to see where you can make a contribution of an article to an area perhaps you hadn't thought of. Great magazine – keep up the good work – W4UXJ.

NEW PRODUCTS

New "Thermal Spot" Locates Circuit Faults, Serves As Heat Gun



Wahl is introducing its Thermal Spot Tester as a new type of electronic circuit fault detection method. The Thermal Spot is a small blower heater with an extension tube. Providing 260° F directed at a single spot, it heats up individual capacitors and transistors to find malfunctions that only appear when circuits are warmed. Wahl claims the Thermal Spot is faster, safer, more convenient and more economical than the opposite method of warming up the entire set and chilling individual components.

The Thermal Spot has other uses, too, says Wahl. With or without the concentrator nozzle tube, it can dry epoxies or tuners and other components after cleaning. It can be generally useful anywhere a heated air stream is needed.

For more information, write Wahl Clipper Corporation, Sterling IL 61081.

LETTERS from page 14

LET'S GET GOING

In many of the ham publications, including 73 and QST, we're seeing advertisements on minicomputers and associated hardware but I have not seen any articles, except for a recent one in Popular Electronics, on the subject.

Imagine, if you will, the applications that amateurs can put these units to. How about a system that will monitor all aspects of a repeater station and, if something goes haywire, transmit a recorded message on a discrete frequency regarding the particular problem? Similarly, what about data link-ups with the Oscar satellite? The possibilities are endless!

I understand that the state of the art is such that alphanumeric readout (common letters and numbers) is possible. If we can be inventive with SSTV and transmit data signals around the world, this should be within the realm of reason. Here's an area when the "home brewers" can really shine! The industry is young and the talent within ham circles (remember we already have one who just won a Nobel Prize!) can put Bell Laboratories to shame!

I would sure like to hear from any hams working on this already (now why the devil haven't you spoken up before?) and ones who'd like to. Wayne, we can probably get a column going on the activities across the country (and world) and the new field means more advertisers for hamdom (and, therefore, more popularity, bigger issues, etc.). Come on, fellows, let me hear from you and let's get something going on this.

Richard M. Bash WB9EUV
Fairbanks AK

GOODER GOODIES

First — my Voxpoop vote goes to the Ancrona Corporation ad on page 141 of the December issue. I've been scouring the ads for 2N3053, 2N5323 and other transistors — now only to figure out how to divide it up for $10 worth.

Next — I have no problems with a code free license class despite the fact that 90% of my operating is currently on CW. I think that code free licenses in certain VHF bands would be great with reduced requirement for HF. Even though I've had my Extra for awhile before "incentive" licensing, I would vote to give back the bottom 25 kHz frequencies and extend extra phone privileges a bit. The reason I operate CW is that I like QRM free QSOs, don't like roundtables and enjoy the "skill" factor. From experience it *is cheaper* to build CW gear from scratch than SSB gear, so I would like to see it maintained as a way of promoting technical competance — but see no reason why it is needed as an *entry* to amateur radio.

Last — how do you find advertisers with more and different goodies than QST or HR? I find that designing and building gear provides a similar function to CW — people should do it because they want to, because they enjoy it, because they get a kick out of it — not because they have to. Also, like CW, I would think it a great loss if we did not have the option to do it so keep finding advertisers that sell parts and I'll keep buying.

Bill Farone
Teaneck NJ

BRILLIANT IDEA

This is just a quick note of appreciation. Being a new XYL had its more difficult moments especially when it came to Christmas presents for my OM. However, I must give you and your magazine credit for a brilliant idea. I got him one of the package deals on back issues. What a hit! (Of course, I can't remember what his face looks like, but I sure am glad you have interesting covers as I am always staring at the back of one.)

Thanks again for a great gift idea.

Evelyn Cronyn
XYL of WA1UIG

PUTTING UP WITH GREEN

I can continue to put up with Wayne Green for the rest of my life and his, if you will continue to publish articles of the quality of "The Mystery of Antenna Radiation" in the March 1975 issue.

Dr. Young VE3DDS is in the class of Dr. Peter Paul Kellogg who taught this dumb Ham about Radar at Bell labs in the beginning of WW2. Kellogg taught me to use Time Constant, and Young, with his most clear instructive style of writing, has me seeking after light again in the right way.

My radios and cameras keep me young. I have all the law allows in power on most all bands, thus my interest has been antennas for a long period of time. My antenna farm will soon have some new ideas for radiators installed.

My thanks to Dr. Young for the time he spent writing the article and to you for publishing it.

Phil A. McMasters W4BCZ
QCWA, OOTC
SM#IEEE, Past Chairman IRE, S.C. Section
Senior Engineer, Western Electric (RET)
Consultant, Fred A. Smith, P.E. Charleston, S.C.

HELP!

I am writing on behalf of a cerebral palsy victim, a 17 year old boy, who is interested in amateur radio. The boy is totally incapacitated as regards use of his limbs, but he h as some movement of head, neck and facial muscles.

I appeal to any and all hams who have worked with similarly handicapped persons to advise us of problems they have encountered and solved.

I understand that various special controls and harnesses have been built for other victims so that the small muscular movements possible can be applied to perform various ON/OFF and adjustment functions. The Morse code has been sent by either muscular movements or by breath sounds.

May we see someone's designs (or be told) of how best to accomplish these things? We will be very grateful. Please send information to:

Mr. Al Ross, Media Department, Child Development and Mental Retardation Center, University of Washington, Seattle, Washington 98105, Phone: (206) 543-4011, ext. 77.

Al Ross
Seattle WA

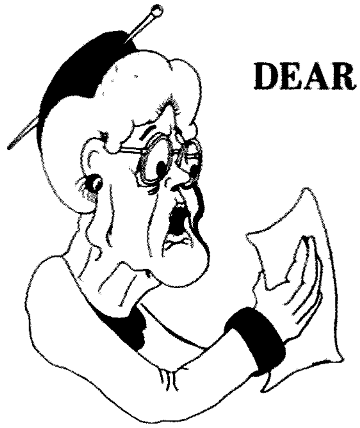
THEY'RE GREAT

Just wanted to let you know how much I think of your CW tapes. I got my Novice and Tech license at the same time in 1966. The Novice ran out in a year and I was still stuck at the 10 word plateau. I've been a Tech ever since.

Last spring I ordered your 14 wpm tape and after copying it for a month, ½ to 1 hour almost every day, I took my general and passed. Three months later, I passed my Advanced. Just can't recommend your tapes too highly. They're great!

Bob Hileman WA8SSM
Weirton WV

Continued on page 173



DEAR GABBY

Dear Gabby:

From reading your column for years I know how often you have found answers for people who didn't know which way to turn, and I hope you can help me with a terrible personal problem. I don't mean give me one, either. Sometimes you like to smart off I've noticed. Anyway, I was ashamed to ask about this before but now it's the style to let it all hang out. We all have troubles. Besides, it's this dummy I'm married to that needs the help.

My husband, so-called, is a ham radio operator. At least that's what he says he is, and how would I know? I don't suppose you ever heard of them but I'll give you an idea of what it's like living with one.

It's only exaggerating a little bit to say our marriage has consisted of a series of brief encounters at the dinner table. Since we were married twelve years ago John has spent eleven plus talking to little boxes in the basement. Sometimes this goes on all night and then he says it was a contest. What kind of contest do you have alone in a basement? He gets his own breakfast before I get up, and after he comes back from work he doesn't come upstairs until dinnertime. His end of the conversation at the table is a thrilling hello like you give someone you aren't sure you know. In minutes he's off again, carrying his dessert and coffee. I remember trying candles and a centerpiece of roses — the response was a fit of sneezing and a prompt check of the lighting fuses. When I invited my brother and his wife to dinner John's routine didn't change except he left a fifty cent tip on the table. I guess he did notice we weren't alone and thought he must be in a restaurant.

For some reason the roof of our house is tied with wires to a lot of trees. When I asked about this John said it was some kind of earthquake protection, but he told the neighbors it was to keep lightning from striking anywhere on the block. On a pole in the backyard he put up a TV antenna so big you wouldn't believe it, saying it would give us a better picture, and now Lawrence Welk comes in on the bias and all wiggly.

Have you heard of lightning rods on cars? Ours has two of them — a little one on the roof and a big one on the rear bumper. More of those little boxes under the dash and cables everywhere. I've snagged my hose and caught my heels so many times I sit in back now. While he's driving John constantly punches buttons and talks into a funny telephone. He never uses the telephone at home and I've never heard of a car being hit by lightning. What's going on?

I asked my mother for advice and that was a mistake. I remember just what she said: "Oh, sure. We had some weirdo neighbors like that. They're called Citizen Band operators. Forget it, honey. It's kid stuff they grow out of." That night I asked John if he was one and just never wanted to tell me. He only gritted his teeth and went downstairs to his wires and boxes. He even forgot to take his coffee. In a few minutes he was back gritting his teeth at me again. This time they were in his hand. Then he flounced out, slamming the door, and spent the night down there. Having another contest, I suppose. Thanks a lot, MAMA.

A week ago a friend asked if I would have her doctor talk to John and I agreed. When he arrived last night we could hear the usual racket from the basement and the doctor hurried down there before I could explain all this funny business to him. In minutes he popped back up, shouted "Ten is wide open!" and laid a nice patch of rubber getting out of our driveway. Dear Gabby, can you help me?

Exasperated.

Dear Exasperated:

What you told me indicates that your husband does indeed have a problem. Ten hasn't been wide open for a long, long time and I think you'd be smart to try a different doctor.

73, Gabby

LETTERS from page 170

ONE LICENSE?

Just a short note to congratulate you on your editorial in the April, 1975, 73 Magazine, on Docket 20282. I agree with you on almost every point. I hope the staff of the ARRL and FCC read this excellent editorial. I received my first license in 1924 and it seems to me that one ordinary license (possibly except for Novices and Conditionals) should take care of all amateur needs.

Lewis S. Lamar
Weston MO 64098

MA BELL

I'm remaining anonymous to avoid a possible confrontation with the Bell System.

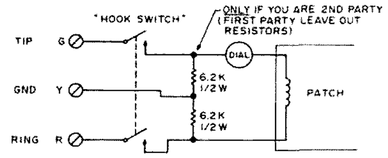
Hooking up stuff to Bell's lines is like fighting a war – you often can make only one mistake. I am among the few in this affluent (or effluent) land with a two-party line. I am also the "second party" thereon. Which means that the ringer is connected:

Wire on Ringer	Terminal on Network W.E. 500 Set
Red	B
Red-Slate	G
Slate	K
Black	B

Now, it has been a well-observed practice simply to get rid of the ringer to avoid detection when you "bootleg" in an extension. However, in this case, removing the ringer also removes a path to ground which signals the exchange that the "second party" is offhook and that calls should be billed to the second party. Remove the ringer, and the "first party" gets billed for all your direct-dialed calls made from that phone!

So, leave the ringer in but move the Slate wire from network terminal K to G, and be sure that the yellow ground wire is carried to the extension. Now the ringer is "gone" when you're on hook, and its high-resistance winding provides the "leak" to ground to trip the billing circuit properly. Needless to say, if you don't take this precaution, a very mad "first party" will start complaining, a truck with a bell on the side will pull up at your house, and you may get stuck with a toll fraud suit.

If you're "brewing" a patch or other device, do it this way:



(Name and address withheld)

REDHEADS

In response to writer Jules W3YZE's observation, ". . . the best one I ever heard was Keeper To Her Majesty's Jewels":

My phonetics may not be better, but, for the rest of my life, I will be Kissing Two Heavenly, Cute Redheads.

Andy Zum K2HCR

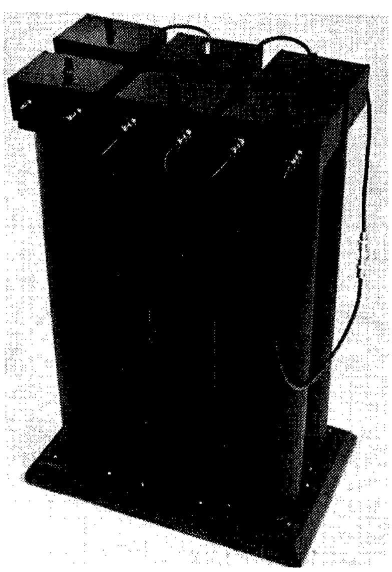
Continued on page 174

SWIVETEK DUPLEXERS

The Swivetek duplexer has been designed to be a low cost, rugged, highly reliable device for use in communications services. The construction of each individual cavity has been designed for accurate and repeatable performance. Cavity sections are made from seamless aluminum alloy tube that is TIG welded to base and top plates. All internal conductor pieces have been highly cleaned and silver-plated for low loss. These in turn are mounted in the cavity with adjustable silver-plated brass bullets, allowing variable position for the control of insertion loss.

Anti-resonant elements are made using strip-line techniques for low insertion loss. High Q air dialectic capacitors are also used. Individual cavities for the 2 meter band have a typical range of 135-175 MHz and by the appropriate anti-resonant element, can be made into high pass or low pass cavities. Inter-connecting cables supplied with all Swivetek duplexers are made of RG-223 cable.

The 6 cavity 2 meter duplexer has been tested and evaluated at 250 Watts rf power. Typical stop-band rejection for high pass and low pass sections is greater than 105 dB, with overall insertion loss less than 1.5 dB typical. These cavities are mounted on a wooden base to provide ground isolation. The split is pre-tuned at the factory for 600 kHz, unless otherwise ordered. Precision tuning service is available for $35.00. Complete instructions are included with every Swivetek duplexer. Swivetek single element and dual element suck-out cavities also are available from *Swivetek, 544 Lassen St., Los Altos CA 94022.*



ASCOM VHF TEST METER

A new multi-tester designed for use in testing and monitoring VHF communications systems has been announced by Ascom Electronic Products, a division of The Antenna Specialists Company. The unit, Model ASMR100, checks both transmitter and antenna operation over a frequency range of 144 to 174 MHz. This range includes the entire 2 meter amateur band.

Featured on the new ASMR100 tester is a dual range wattmeter function, 0-25 and 0-50 Watts. Transmitter output is indicated directly in Watts on either scale with ±8% accuracy.

The price of the Ascom ASMR100 multi-tester is $69.95. Details are available from Ascom dealers or by writing directly to *Ascom Electronic Products, 12435 Euclid Avenue, Cleveland OH 44106.*

LETTERS from page 173

FAX PAPER

I was able to obtain some Western Union telefax equipment at last year's Dayton Hamvention. However I have been unable to get any information on this equipment (no schematics or even operating instructions). The equipment is as follows: Preamplifier #6575-B, Mfd. by Marcon Electronics Corp; Amplifier #5621.1-A, Mfd. by Columbus Electronics Corp., Yonkers, New York; Telefax Recorder #5616-7-A, Mfd. by The Seeburg Corp; Regulator Inverter #6574-C, Mfd. by Marcon Electronics Corp; and Telefax Transmitter #5617.2-A, Mfd. by J. P. Seeburg Corp.

I also have the desk fax unit and plan to build K7QXL's converter in the January issue of 73. Does anyone know where I can get the fax paper for the desk fax? I have the fax paper for the units listed above, and I'm sure that if I could get the main station above operating, I would have a terrific fax station. Any help that readers can give will be appreciated. I am also going to write to Western Union to see if they have anything on the units.

Jeffrey White
Albany Road Box 142
Athens OH 45701

CLASSES GROWING

Thanks to your recent comments, I have been sparked into starting up the school radio club which until now was made up of only two amateurs.

At present, two persons have taken the Novice test and the code and theory classes are growing larger. (75% are CBers!)

Thanks to you, and my advisor, Ted Johnson WA1KJI, I sincerely doubt if this would have even made it off the ground.

Keep up the good work and maybe soon I'll even get on 2 meters and have a rag chew with you!

Mike Taylor WN1TBV, WA1CCH
Mount Anthony Radio Club
Bennington VT

ULTIMATE PORTABLE

How often have you missed an important sked, failed to check into your favorite SSB net, or, for any number of other reasons, been unable to get on the air because you had to leave the shack to go into town or to do something else?

My ultimate portable lets me have the facilities of a 1 kW transceiver almost anytime or any place without hauling a truckload of antennas and equipment around. Even while at work I can contact others during my coffee break.

Actually all I do is pick up any telephone and call the private line in my shack at home. When the phone rings, a relay connects the phone line to my phone patch and the rig is left on VOX.

When I hang up the phone, the relay disconnects the phone patch and everything is restored to normal.

I'm sure you can see the possibilities of this system. It turns any telephone booth into an instant ham shack. A small battery operated tone encoder (Egbert Electronics' "Select Call") satisfies the requirement of maintaining control over my transmitter.

Try it, you'll like it.

RJ Bareham VE1AFM
Hubbards NS

MISSILE TUBES?

I just received your February issue and read the comment on page 160 on transistors in nuclear blasts. Being a physics major, I've inquired about this and it seems tubes would be great in a situation like this when used in defensive or offensive missiles.

How do they cut down the power requirements? From what I could gather a radioactive filament is used needing no current. I was wondering if any readers know more about this. I can't seem to get any information on it. Seems this could be a tube come back.

T. Mohr
1513 Tracy
Green Bay WI 54304

ENJOYABLE

I would like to thank you and your staff for a very fine and informative magazine. I particularly enjoyed in the past two issues the articles about the proposed rule changes in the entrance into Amateur Radio for those who at this time do not particularly relish the prospect of going through the hassle of learning code and also going through the General Class Theory just to be able to work on 2 meter FM. This is especially enjoyable to me because I am a member of the American Red Cross Disaster Services in Huntsville, Alabama, and the local radio club – Huntsville Amateur Radio Club – has a base station here at the Red Cross Chapter House. This would allow me to assist more with the exchange of information from the National Weather Service and the Civil Defense stations that are operated during severe weather and tornado watches.

Ralph A. Brigham
Huntsville AL

POWER DENSITY

I read the article on antenna gain by Pete Stark in your March issue with great interest. Even though we are going metric, the formula for power density can be worked out in miles very simply. As a matter of fact, the power density will immediately be expressed in microwatts per square meter.

The "new" formula is:

$$\underline{P} = \frac{.3861\ Pt}{4\pi r^2}$$

where "$\underline{P}$" is in microwatts per square meter and "r" is in miles.

Using the example in the text, a 1000 meter radius sphere is approximately .62 miles. Plugging into the above formula we get:

$$\underline{P} = \frac{.3861\ Pt}{4\pi r^2} = \frac{38.61}{4.8305} = 7.99 \text{ microwatts per square meter.}$$

For myself this means my QRPp rig with a Watt and a half input is pumping all of about 3 picowatts per square meter into Milwaukee, Wisconsin from my QTH.

Thanks for such an interesting article and keep up the good work.

John A. Czupowski WN9OTE
Cicero IL

HOTLINE NETS

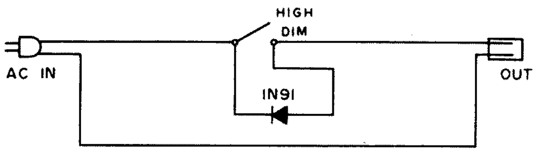
Your suggestions in 73 Magazine and in the Hotline newsletter for the organization of more technical and theory nets is excellent.

Would it be possible for 73 Magazine to gather together and publish occasionally a listing of the technical and theory nets with day, time and frequency of operation? This could be very useful information.

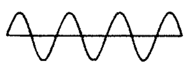
Robert E. Becker
Kent, Washington

Splendid idea – all scheds will be listed in Hotline – please send a card giving days, time and frequency of all theory and code practice scheds . . . Wayne.

CIRCUITS, CIRCUITS, CIRCUITS.

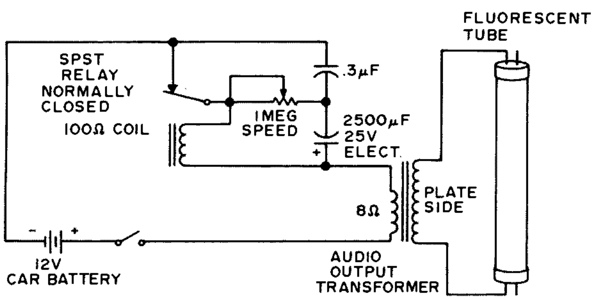


Cheap light dimmer. The diode is a 200PIV 1A. In series it changes the line voltage from

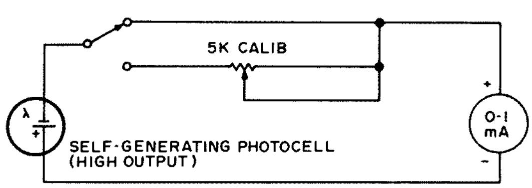
this  *to this:* 

which is ½ the voltage.

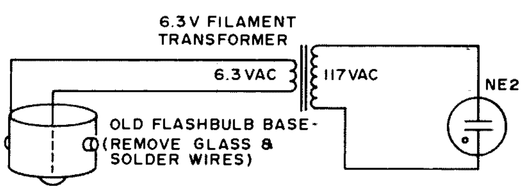
Use this circuit on lights, motors, etc. Using it with a 3-way lamp will give you a 6-way lamp. — WA3SWS



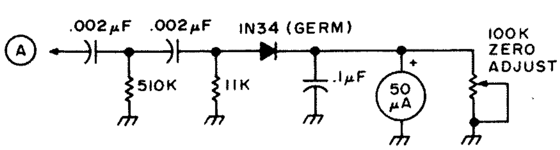
Really great car emergency flasher. This is really bright! Relay is mechanical dc to ac converter. Each time it opens up the inductive kick is stepped up in the output transformer and ionizes the tube. — WA3SWS



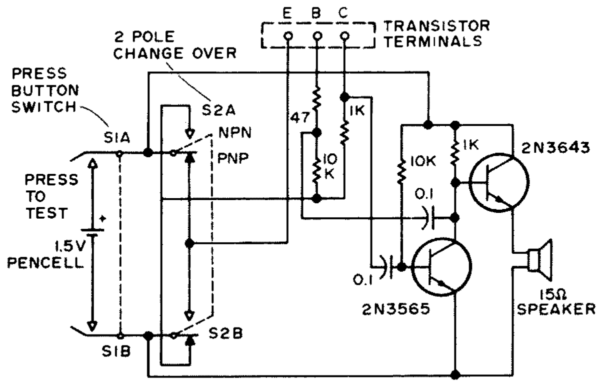
Light meter for ATV fans — WA3SWS



Flashgun tester. Plug base of old bulb into flash-gun. If neon light flashes, flashbulb will too. —WA3SWS



S-Meter for Regency HR-2 series. "A" goes to emitter load resistor of detector. — WA3SWS



Transistor tester for all types of bipolar transistors, both small signal and power, silicon or germanium. Tone of about 1 kHz when transistor is good. AA battery will last about two years. Thanks VK5GV — and a SSTV book for your effort is on its way.

APRIL FOOLED?

Us. Through no fault of Bob Harding's, the mH's for his Torrid Toroid (page 37) turned up as MHz's. You knew what we meant.

You? Many readers (not to mention us) feel that WAØABI may have picked up his Voltmeter Switch Quiz (page 38) from the Extraterrestrial Repeater (page 21).

Be My Guest from page 5

in the very affluent Hudson Division. Go upstate or to Appalachia and see for yourself. I've lived for several years in both Vermont and Minnesota. I know a game warden ham who earns about $600 a month, runs a trap line on the side, and comes down to Highway Patrol Headquarters to occasionally scrounge an 807 or a resistor. Do you think he can afford that $9? Those of you who are old enough to remember the Depression days in the "thirties" know what I am talking about. Both Harry and Stan are too young to remember those days, bad days even in the Hudson Division.

These fellows are insensitive to the economic crunch on the ham in other Divisions. And those fellows in Newington are running the ARRL like the hard-heeled businessmen they are. Stan's Fall 1974 Newsletter says, "Today it is the numbers game that counts, and brings in the dollars." (To whom?)

These fellows have lost touch with the fundamental traditions of ham radio.

Second, the desirability of the "no-code" license has been brought up before. Let me read, in part, a letter published in *QST* some years ago:

"For years there have appeared in our Correspondence columns criticisms of the trend towards manufactured apparatus, not components but read-made units for the 'amateur amateur' whose only contribution to the design of his station is the placement of it in the living room. Let us by all means take advantage fully of the splendid array of new tubes and components made available by commercial research. It is not this that spoils the amateur game; it is the availability of 'amateur' transmitters and receivers, now sold not only by the old firms from whom we have been buying parts for so long, but by others who suddenly realize the existence of a new lucrative field. Some of these jobs (not all) are well engineered units. But if the ARRL is still an amateur organization it should do something to discourage this particular type of commercial expansion. Already it is leading to agitation for the removal of code requirements for five meters; this can only be to enlarge the market for manufactured transceivers. None of us wants to kill legitimate business when it is legitimate, but if the manufacture and sale of complete units continues at the present rate, these 'amateur amateurs' will grow in number until they can outvote the rest of us in our own organization, the ARRL. Then good-bye code test, good-bye operating efficiency, good-bye emergency organization, good-bye our spirit of research, progress and brotherhood. Ten million bored stiffs will sit in front of ten million identical rigs; 'Amateur Radio' will be a bigger business than ever before, but its soul will be dead." (G. S. Light, ex-VE3ABW, *QST,* Feb., 1939.)

These words, written way back in 1939, are still applicable today, aren't they? I asked the editor of *QST* to reprint it, back in January, and got the usual brush-off post card, "... held for possible use ..."

Those proponents of the "no-code" license, especially Harry, expect that it would open the doors for new hams, getting them started, so they can advance up the ranks to real amateur radio. Bunk, I say. They point with pride to the Novice program as the great "open door." But, don't you remember? Novices were originally permitted to use 'phone on 2 meters. They changed that when they found that those Novices seldom advanced up the ladder. Now, Novices are not permitted to use 'phone.

If this "no-code" Communicator Class comes to pass, I would like to predict the results to be as VE3ABW predicted years ago. Only now, Pandora's Box will have been opened, and these operators will largely consist of a stagnant, CB-type group with no intention of upgrading to become real radio amateurs.

What am I asking you to do? First of all join the ARRL. (It *is* the only game in town.) Vote carefully in Director elections; put up a more sensitive candidate. File directly to the FCC.

... Byron W2JTP

PS: I've been an ARRL member for more than 30 years; I'm now a life member. I hold an Extra Class license but operate much more 'phone than CW. I am not a candidate for Hudson Division Director; I will not run for that office.

73 reader service

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PROPAGATION CHART

J.H. Nelson

Good (open) Fair (□) Poor (O)

June – 1975

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	$\boxed{2}$	$\boxed{3}$	$\boxed{4}$	5	$\boxed{6}$	$\boxed{7}$
8	9	10	$\boxed{11}$	$\boxed{12}$	$\boxed{13}$	14
15	16	17	18	19	20	21
$\boxed{22}$	$\boxed{23}$	$\boxed{24}$	$\boxed{25}$	26	27	28
29	30					

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	7	7	7A
ARGENTINA	14	14	14	7	7	7	14	14	14	14A	14A	14
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7A	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	7A	7	7	7	7	7	7A	14	14	14
INDIA	7	7B	7B	7B	7B	7B	14	14	14	14	7A	7
JAPAN	14	14	7	7	7	7	7	7	7	7	7	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	7	7B	7B	7B	7B	7B	7	7	7	7	14
PUERTO RICO	14	7	7	7	7	7	7	7	7A	14	14	14
SOUTH AFRICA	7	7	3A	7	7	14	14	14	14	14	7	7
U. S. S. R.	7	7	7	7	7	7	7	7A	14	14	14	7A
WEST COAST	14	14	7	7	7	7	7	7	7A	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	14	14	7	7	7	7	7	7	7	7	7A
ARGENTINA	14	14	14	7A	7	7	7	14	14	14	14	14
AUSTRALIA	14	14	14	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7	7A	7A	14	14
HAWAII	14	14	14	7A	7	7	7	7	7A	14	14	14
INDIA	7	7	7	7	7B	7B	7B	7	14	14	14	7
JAPAN	14	14	14	7	7	7	7	7	7	7	7	14
MEXICO	14	14	7	7	7	7	7	7	7	7	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7	14
PUERTO RICO	14	14	14	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7	7B	7B	7A	14	14	7	7
U. S. S. R.	7	7	7	7	7	7	7	7	7A	7A	7	7

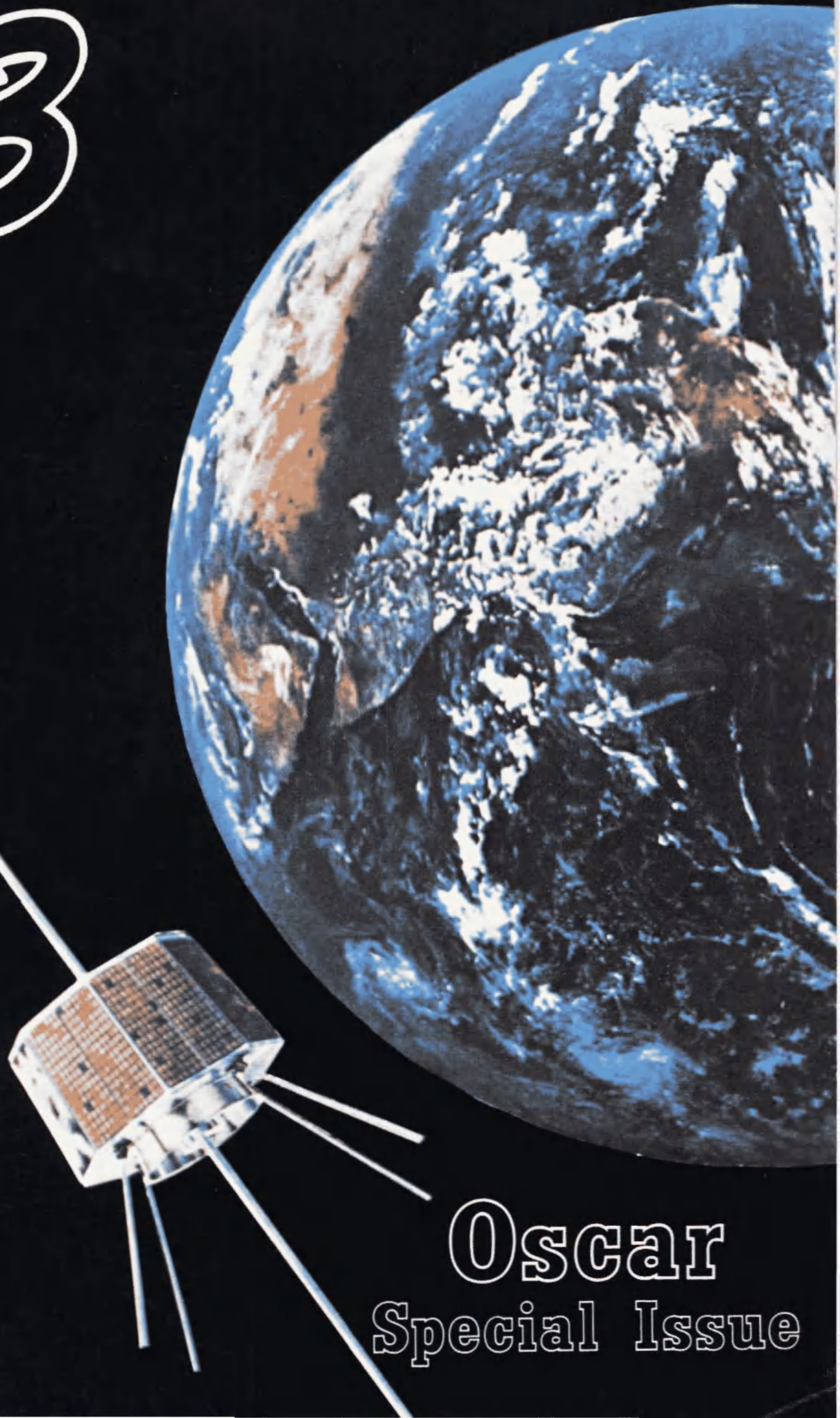
WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	14	14	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	14	7A	7	7	7	7A	14	14	14	14
AUSTRALIA	14A	14A	14A	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7	7	7	7A	14
HAWAII	14	14A	14	14	14	7	7	7	7A	14	14	14
INDIA	14	14	14	7B	7B	7B	7B	7	7	7	7	14
JAPAN	14	14	14	14	14	7	7	7	7	14	14	14
MEXICO	14	14	7	7	7	7	7	7	7	14	14	14
PHILIPPINES	14	14	14	14	14	7B	7	7	7	14	14	14
PUERTO RICO	14	14	14	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7	7B	7B	7B	7A	14	7A	7
U. S. S. R.	7	7	7	7	7	7	7	7	7A	7	7	7
EAST COAST	14	14	7	7	7	7	7	7	7A	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

JULY 1975
ONE DOLLAR

73 amateur radio



Oscar Special Issue

73 amateur radio

#178 JULY 1975

COVER: Photo provided by Alan Bridges WB4VXP, 2881 S. Main, Kennesaw GA 30144, who has 8x10 copies available for $3 (or 20 IRCs). Order from Alan, but make checks payable to AMSAT, which gets the proceeds.

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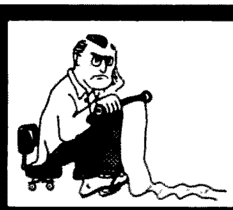

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

DANGER: OSCAR!

Oscar holds out the same promise... something like a life on drugs.

One of the most virulent mental diseases ever to hit amateur radio has been something very obscure – something called Oscar 7, mode B. It only takes the slightest exposure to this to reduce a normally healthy ham to a wide eyed fanatic, looking frantically for some way to get on 432 MHz.

If you've been around amateur radio for any length of time you've had an opportunity to try to reason with a DX-crazed inhabitor of the pileups – you may have even talked with more than one of these poor people, whose very life structures have been twisted horribly by fate so that their work, their family life and their entire existence is wholly dependent upon being able to work DXpeditions. Oscar holds out the same promise... something like a life on drugs.

You say you can listen in and not get hooked? Ignore, if you will, the testimony of thousands of lives, reduced to shambles, now being spent waiting for each next orbit of Oscar... or Oscars... there are two up there now.

Let's see if you have any guts. Let's see if you have the strength of character to listen in to Oscar. That's right... all you have to do is listen. Nothing serious can happen from that, right? So you'll listen and maybe you'll hear some stuff. Big deal. You can hear a lot better on 20 meters, right?

Both Oscar 6 and 7 are relaying signals from 2m to 10m, so you have plenty of opportunity to tune them in. It doesn't take much of an antenna either, though you can always use a little better antenna or a lower noise receiver to get a little better reception. If you have a 2m receiver which can pick up CW or SSB you are even better off, for the 2m signals from Oscar 7 in mode B are almost unbelievable at times.

You have to know two things, obviously... when to tune in and where to tune. The where is the easiest – with Oscar 6 (let's call it O6) you tune around 29.5 MHz. The signals should come in from 29.45 to 29.55 MHz, and you may hear a telemetry beacon on 29.45. The signals coming out on these frequencies are going in from 145.90 to 146.00 MHz. Many of the fellows are using low powered FM rigs, keying them with the PTT for CW, to get into the satellite. O7 comes out from 29.4 to 29.5 MHz and goes in from 145.85 to 145.95.

The when to tune is a bit more complicated, but not seriously. The orbital data is printed in 73 and in Hotline, with one orbit per day listed for each satellite. From there you can figure out the rest in a couple of minutes. It's easier if you use a hand calculator, but you don't really need one.

The orbiting data tells you the time and place Oscar crosses the equator in an ascending orbit for the first time each day. Next you'll want to project the time and place for each successive ascending orbit crossing. Oscar is going in a circle around the globe, crossing near the poles... about 12° tilted from the axis of the earth. The earth turns beneath it. It takes Oscar about 115 minutes for a complete loop. Take a sheet of paper, and put down the orbit number for the first daily orbit and those for the next twelve orbits under that in a list. Put the time for the first orbit and then work out the times for the next twelve equator crossings (ascending, of course). It will be two hours later for each one, less five minutes. You can make a third column for your local time, if you think better that way, since the orbit time is in GMT.

The chart gives the longitude of the first crossing... put that down. Add 28.7° (29° is close enough) to that for each succeeding crossing, and put that on the list. You can check an atlas to see where you live in longi-

tude . . . 75° runs through Philadelphia, 90° through Chicago, 105° through Denver and 120° through L.A. You'll be able to hear the satellite when it is within about 45° of you. If you have a world globe you are really set, for you can draw a circle 4000 km in radius around your shack and see just when the satellites will be in range. Lacking a globe, you can make a rough estimate of how long after it passes the equator it will be before you will be able to hear it. Figure that if it passes right overhead you will be able to hear it about 24 minutes total. A line across the country from San Francisco through Oklahoma City and Norfolk is about 12 minutes away from the equator so you'll hear it as it comes over the equator if you live along that line and it is going to pass overhead. If it is about 15° from you, figure it'll take about a minute extra. At 30° add three minutes. At 45° it'll take about 10 minutes and you'll only hear it for a short while . . . but this gives you the best distance, so it's worth it. Add about a minute for each 200 miles you live north of the Norfolk-S.F. line.

Okay, now you have your times for ascending passes. When Oscar is ascending on the other side of the world it will go on up and over near the pole and come down over you on a descending pass. You can get a good idea of the times for these by making a further column on your list for descending longitudes . . . subtract 166° from the ascending longitude. Add 29 minutes to the ascending equator time and you'll know when it has passed the pole. This is a good time to start listening.

There is much to be said for getting a world globe for working out exact satellite passes . . . or else a map made for this purpose. The chances are that you'll be able to hear at least some of about ten of the thirteen passes it makes each day, providing you don't have to be away from the shack for more than an hour and a half or so at a time.

The present schedule calls for Oscar 6 to be turned on Sunday morning and evening (local time) as well as Wednesday and Friday evenings. Oscar 7 will be on the 10m output every other day (listed as mode A on the orbital lists), but it is not used on Wednesdays. On the even numbered days of the year (starting from Jan. first), O7 is in mode B, listening from 432.125 to 432.175 MHz and relaying this from 145.925 to 145.975 MHz. Mode B is working the best, with signals often reaching S-7 or better even with relatively poor receivers. Other than the Wednesday rest period, O7 is on all the time.

Once you've heard the signals you'll want to give the system a try. The mode B, while it is easier to hear, requires more sophisticated equipment, so you'll probably start out with the mode A relay first. Many amateurs have managed contacts using FM rigs, keying the mike button . . . even the TR-22 has made it many times with its one Watt output. Sideband is more complicated unless you have an Echo or Multi-2000 transceiver. CW on 432 is not difficult with converted commercial FM gear, but again, sideband requires a lot more effort.

Let's take Saturday, July 5th, and work out a schedule for O7 in mode B from the published orbital info. You can cheat and get this all worked out for the whole year for both satellites from Skip Reymann W6PAJ, Box 374, San Dimas CA 91773, for $3.

Continued on page 158

Orbit	GMT	EDT	Equator longitude	Descending longitude	Time over pole	Estimated acquisition
2898B	0011	(July 4) 2011	52.7		2040	2016-2037
2899	0206	2206	81.5		2235	2209-2230
2900	0401	(July 5) 0001	110.2		0030	0015??
2901	0556	0156	139.0		0225	
2902	0751	0351	167.7	1.7	0420	
2903	0946	0546	198.4	30.4	0615	0627??
2904	1141	0741	225.2	59.2	0810	0815-0835
2905	1336	0936	253.9	87.9	1005	1007-1030
2906	1531	1131	282.6	116.6	1200	1201-1220
2907	1726	1326	311.4	145.4	1355	1353-1402
2908	1921	1521	340.1	174.1	1550	1547-1553
2909	2116	1716	8.8		1745	1738-1747
2910	2311	1911	37.6		1940	1919-1940

HOTLINE HEADLINES

CB Mags continue to advertise illegal linear amplifiers "not for CB." FCC is not amused and repercussions could be serious to amateurs as a result of FCC attempts to stem 11m amplifiers.

W8HRV is the winner of the Chronex digital LED readout watch in the 73 Magazine bumper sticker contest at Dayton Hamvention.

Dayton pulls nearly 12,000 this year – event is beyond description – flea market boggles 173 minds, Dayton hospitals reported filling up with amateurs raving over the incredible bargains – exhibitors reported leaving wide trails of excess cash as they struggle homeward after the convention with boxes of money, bags of money, and pockets bulging – so where's the depression?

Reaction to 20282 changing – more and more resistance to Communicator license despite heavy ARRL pressure in favor.

Fred Laun W9SZR/3 awarded Foreign Service Award for Valor by Kissinger.

Oscar 8 plans progressing – equipment to be made almost 100% in other countries. Need for an Oscar 7-1/2 is becoming obvious as 2/10m translator will be important to continue after Oscar 7 fades away and before Oscar 8 is lofted – plans being made.

K4LSP continues repeater war in Tennessee via WR4ADO despite attempts by repeater council and coordinators to cool the battle – Eddie Palmer on the way toward winning citation as disgrace of the year.

New phone rates for one minute excellent for ham scheds – Ma Bell is not all bad.

Silver Box – new phone gadget which permits you to listen in on any line – Bell hoist on own petard as gadget allows people to use Bell system for monitoring company business office calls – Congress investigating invasion of privacy.

WA4SAM theft – the SAM car is rigged to blow the horn, sound a siren, and flash the headlights when broken into – plus a goodly signal on two meters. When the car was stolen the other day the thief made the cleanest get away in ham mobile history . . . according to WA4LCL.

BE MY GUEST

Visiting views from around the globe.

QPR: Quality Public Relations

In the last few years hams have had several problems to cope with. Among these are A. Prose Walker, the EIA and the 220 MHz bit, TVI complaints which turn out to be CBers, etc. But the most drastic problem to face U.S. amateurs in recent years is the dwindling number of hams joining the ranks.

After reading Wayne's March editorial, I really hate to make this next statement, but it is the truth. The real blame for the lack of interest in our hobby by the public lies with the hams themselves. The public has many people itching to get into some kind of radio, and most turn to CB. Why? Well, it is fairly evident. The public knows more about CB than amateur radio. The fault for this lies within the already established amateur ranks. PR is the name of the game and some of us have yet to learn how to play it!

This game is rather simple to play and has only one really important rule. BE WHERE THE PEOPLE ARE! This means most anywhere. Where people congregate in numbers, amateur radio should be there, too! You don't make the public come to you — you go to the public. Shopping malls make a fantastic place. In the neighboring city, the area malls host everything from ballets to horseshoe throwing contests. By merely being there, these events cause the people to stop and watch.

The greatest numbers of potential amateurs are at the local high schools. If they don't have a radio club, start one. You'll find help from the resident electronics teachers, math teachers, etc, I'm sure. The administration might not like the idea of putting up antennas, of course, but if you work it right you can turn their relentlessness into interest.

Get the local amateur club into the act. Set up a booth at the numerous county fairs. Appear where least expected — at CB coffeebreaks. If CBers knew more about ham radio we could turn them into a decent breed of hams. Set up some kind of public function and invite the newspapers, radio and television stations. Invite them to your hamfest, etc. Let everyone know that HAM RADIO IS AROUND.

Include in your demonstration as many different facets of the hobby as you can get your hands on. This not only draws interest but also serves as an incentive to those who already have their Novice licenses. SSTV, RTTY, FAX, FM, ATV, CW, SSB, HF, VHF, UHF, antennas, building — they all should be there. Have recent ham publications around for people to browse through. Catalogues of different types of equipment should be on hand. There's nothing as impressive as an S-line. Get young and old hams there. Get the people involved and don't stop there.

After you have gotten to the public, let it be known where classes are being held. Of course someone in your town is holding Novice classes, aren't they? If not, start them.

Remember, don't lecture the public — that doesn't help at all. Just make it super interesting and you'll have more bites than you can handle.

We hams have to get to the public to help our dwindling numbers or the FCC will try, and we've seen what that has done in the past. Give your club a purpose, if you don't have one, and work on it!

Mark D. Poss WB8URH
Fostoria OH

¿ Thirteen Billion

Lou Breetz W3LB gave a talk at the club meeting on April 3 about the U.S. Satellite Detection System's main transmitter and antenna array, operating in Texas. Lou was head of the Transmitting Section of the Space Surveillance Branch in the Applications Research Division of the NRL while this project was being developed and gotten into operation. Operating at 216 MHz with a continuous rf power output of 10 megawatts and an antenna gain of 41.3 dB from a 2 mile long array of 2550 inverted V dipoles, this system develops the ERP referred to above. The antenna pattern is fan-shaped, with the broad dimension along an East-West line, and the angular thickness of the fan pattern is about 1½ degrees from North to South. This huge array has a near field pattern up to 2000 miles above the earth, before the far field pattern starts to form.

Since the system's purpose is to detect any potentially hostile nuclear weapon satellite, high reliability of the design was required. Two separate commercial power sources are available, and four master frequency sources are installed, backed up by storage batteries to insure continuity of frequency stability. Any of the 18 bays of antennas, each bay fed by a 60 kW transmitter, can drop out without any major effect, and the drive to that section is automatically switched to a dummy load.

Each transmitter uses five type 6166A tubes with 12 kW plate dissipation each, and operating at about 50% efficiency. Styroflex coaxial cables, to the extent of 15 and 20 miles' worth, run from the antenna bays to feed

W.J. Howard K1LNJ/3

my view

There I was, cheerfully working away at my overdue income tax returns, and in walks an old friend. Price, you ole son-of-a-gun, I said. How's things – is the Federal Candy Company keeping you busy? After a thoughtful pause, Price begins his woeful story. Well Bill, to tell you the truth I haven't slept in days. Say Price old man, now that you mention it, you do look in bad shape. Pull up a chair and let's hear about it.

Well, you know about this restructuring proposal we've had going for awhile. Oh yeah, that's the 20282 I've heard so much about lately. Right, that's it – well anyway, you know we've been trying to find a new home for the citizens banders for a long time and this is it . . . Wait just a minute there friend. I think you're talking about the wrong one. Don't you mean the Class E proposal for 220? No, no – see that's just it. I mean 20282, but let me fill you in a little bit first.

For years now the citizens band has just completely gotten out of hand. Most of the legitimate users moved out long ago and the ones still there give me nightmares, but that's not the problem. The problem is that the CBers don't want to move. Now we tried the Class E proposal, but not only did the CBers complain, with their Washington lobby and all, but the hams put up such a ruckus that between them they just about killed Class E. Now normally that's that, but not in this case. Some real big guns over at the Electronic Toy Association want the CBers to move as badly as I do, but for a different reason. They figure that once we find another place for the CBers, they'll be able to sell a lot more toys. Maybe three to six hundred bucks or so per CBer times about 800,000 of them makes for some big bucks. Well anyway, with a carrot that big, they don't want to see it disappear just because people don't like Class E.

OK, I follow you so far, but what does this have to do with amateur restructuring? A lot my boy, matter-of-fact it has everything to do with amateur restructuring. See, it doesn't really matter if we call the new CB class citizens band or amateur radio, as long as they move. The point is that if we give them an "incentive" to become Communicators, like officially closing down 27 MHz CB and moving some military transmitter in there, we'll have the same thing as if we had a Class E service. Not only that, but there'll be a whole lot less opposition than there was to the Class E thing.

But you already said the hams are helping kill Class E . . . Why wouldn't

Continued on page 7

Watts ERP?

information to motor driven phasing equipment. This phasing system tends to go wild when a cloud passes low over an end of the 2 mile array. The phasing cables are run underground in controlled temperature water jackets.

Receivers for the system are located at considerable distances from the transmitting site, and common lines between all sites provide signals accurate to 1 Hz in frequency.

Several of the people on the transmitter and antenna project were amateurs, and a man from ARRL came down to look at the system and its antennas. The dipoles are phase-sensitive to ice accumulation on their ends, so special cones were installed to keep ice formations spaced away from the tips. The system went into operation in 1966 and is in active use. The electric bill before the price rises was $18,000 per month!

Ed Westbrook K3CS

Reprinted from *Auto-Call*, May, 1975, p.19.

MORE HOTLINE HEADLINES

HB9PJ saves another life. Fernand made the papers again by getting medicine to a man in Romania. Just a few years ago he did the same for a Polish child and got ham radio excellent PR.

CB cleanup program instituted by amateurs in New York is remarkable success with over 100 CBers being cited by FCC plus arrest of four illegal aliens, four persons in possession of stolen radios, twelve on gambling charges, 19 on narcotics charges, etc.

QSL returned by Post Office – addressee moved – only hitch was that card was sent 27 years ago by Borcher of Omaha and just returned! Post Office reached new levels.

F3 magazine folds after two issues – insufficient support of readers and advertisers cited – residual reaction to . . . rpt alleged.

FCC cites amateur 30 cycles into Extra Class band! Too busy with this nit picking to bother the CBers?

Canadian crossband repeater authorized – DOC not trying to stifle amateur pioneering. Walker, take note.

Tufts Radio growing to be biggest New England ham dealer – reports Multi-2000 sales are booming – other dealers concur. Yaesu readying FM/SBB rig to meet this new market demand.

More CBers blunder onto ham repeaters with stolen rigs – fast thinking hams con them into revealing themselves and arrests follow – happened with WR1ABQ in Derry NH and WR1AEA on Mt. Mansfield VT.

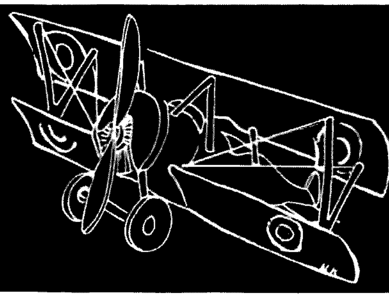
Ham market holding very well – magazine ads up substantially with 73 leading, up 20% over 1974, QST up 16%, HR down 2% and CQ down 24%.

FCC steps in to sit on W6 hogging Oscar with overpower. Shades of CB!

FCC okays six callsign blocks – expect companion docket to 20282 designating callsigns for each class of license soon. Amateur call formats can be: W1A, W1AA, W1AAA, WA1A, WA1AA, WA1AAA . . . with K, N and AA-AL prefixes also available.

Autobiography of an Ancient Aviator

W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230



KELLY FIELD
and the
Happening of September 3rd

The 1922 Advanced Flying School at Kelly Field was composed of ground school and three flying schools: pursuit, bombardment and observation. The five best suited cadets got fighter training, seven were assigned to bombardment training and all the rest, including myself, were assigned to observation training. Ground school was in the morning and flying in the afternoon.

We all had schooling in the operation, repair and maintenance of liberty engines and training in DH4b rigging. Other subjects covered were aerial photography, radio and Morse code, anti-aircraft and searchlights, maps, reconnaissance missions, artillery regulage, aerial gunnery, infantry contact and a lot of army related subjects such as staff duties, rules of land warfare, combat orders, tactics of other arms, military law, army reg., field service reg., service of supply, etc. They kept us busy.

At Kelly Field army discipline was slightly relaxed. We had to stand reveille but no other formations, except to stand in front of our planes for instruction when we were scheduled to fly. Of course we had to stand at attention beside our bunks for the Saturday morning barracks inspection by the Detachment Commander. This took him about two minutes and then we had the rest of the weekend off.

In the flying department the observation and bombardment cadets had DH4bs with liberty engines for equipment. We were paired into teams for our flying. My teammate was Homer Munson. One of the field regulations was "no stunting in DHs" so when pushing DHs around got a little tiresome I'd go over to the pursuit hangar and borrow an SE5 to "wring out" for half an hour or so. In September the SE5s were condemned and withdrawn from service as a result of an accident that Cadet Harris had in one. He dove at a mark on the field and when he pulled out the wings folded and, since we did not wear parachutes in those days, he had to ride it in. None of those who witnessed the crash thought that Harris could possibly come out of it alive. However, due to the fast and expert work of the meat wagon crew that removed him from the wreck, he came out of it with only numerous cuts and bruises, a broken leg, a broken arm and several broken ribs. He was back on flying status again in four weeks.

Last month I told you that Cleo (my wife) was expecting early in September and had joined her parents in New Hampshire to await the event. I felt that this was to be one of the most important happenings in our lives so I requested a ten day furlough to be with Cleo when the baby was born. I had to make some arrangement with Lt. Chauncy who was in charge of ground school with regard to making up the subjects I would miss while on furlough. He knew that I was a reserve infantry officer so he offered to give me a passing 70 with no examination in five purely military subjects that he would schedule during my absence. He also offered to give me whatever coaching was necessary to pass examinations in any other subjects I might miss.

My furlough was from 9/4 to 9/15. I was fortunate to get a lift to Dallas on September 3rd, thereby saving me half a day on my train trip to Littleton, N.H. I thought I would be in plenty of time for the big event since the doctor's prognostication was for September 7th to 14th. But Cleo fooled us all. Her birthday was on September 2nd and her folks and some friends gave her a party to celebrate. Whether the party had anything to do with it or not, Cleo had to be rushed to the Littleton hospital in the early hours of the 3rd where Doctor Giles smartly thumped the new baby's rump at 06:00 and started him on his career. I first learned that my son had preceded me when I arrived in Littleton the afternoon of September 6th. Naturally the hospital was my first stop.

One omission in our planning was brought to my attention immediately. Cleo and I hadn't reached an agreement on a name for the new arrival. Birth certificate and letting relatives and friends know of our good luck, you know. So I assembled a council of a few friends for the purpose of recommending a choice of a name. I won't go into details of our evening long discussion. After much deliberation we chose the original name of Wayne Sanger Green II. That is how and where your publisher was born and named.

The ten day furlough only allowed less than four days in Littleton so I sent a telegram requesting a ten day extension. This was granted at once. I was glad to have this additional time to be with Cleo and Wayne and to do a little local trout fishing. I reported back for duty at Kelly Field on September 25th.

When I checked in with Lt. Chauncy I found that I had only missed three written exam subjects: Staff Duties, Tactics of Other Arms and Combat Orders. These I already knew so I brushed up a bit and had no trouble with the exams. The flying part of the school was different. I had missed several missions. However, when ground school was finished on 9 October I could fly mornings and afternoons. So, with Homer Munson's help, I got through everything OK.

Next month I'll tell you about the flying missions and cross country trips that we made. Also about a couple of situations that might easily have been a bit "hairy".

BE MY GUEST from page 5

they be as upset over the Communicator proposal? For a number of reasons. First off, the only people concerned are amateurs, and they don't have a Washington lobby like the CBers. Next, there's just not that many hams compared to CBers and anyway, most hams figure that if a guy gets an amateur ticket he's paid his dues and that's it. The catch is that we have to make the dues a lot less so the CBers can move. Back in 1971 we made a study and found that most CBers didn't become hams because of the code test, so that's the first thing to go. Next we have to make the test pretty simple and have mail exams so everyone can get his test out of the way in a hurry.

That's a laugh. I've heard that Gettysburg takes about three or four months to get a license out . . . Well, yeah, but that's just ham tickets. We have the CB tickets out in a couple of weeks — so we just gear that operation up for the Communicator Class and have everyone licensed in about a year.

Well, that's OK for you but what about those hams that do object? Actually that one's a cinch. According to International Law we don't have to give a code test if we don't want to, but privileges must be limited to 144 MHz and above. That's the greatest part, since we wanted 220 in the first place anyway. So you see, even if someone does object, we can still put it through just like we did with citizens band in the beginning. Really though, most hams should be so upset about the other trivia in 20282 they won't even bother objecting to a Communicator Class. Their attention is going to be on the loss of privileges, so while they're busy justifying their own piece of the action they'll forget about the Communicators. And that power proposal, that's a beauty — that one should keep 'em going right up to the deadline and then some. What most of them don't realize is that with a few thousand comments on the docket most of them will conflict. Then we do the same thing we did with the original 35 petitions — discard them.

You might run into some trouble if the American Rotary Rhombic League ever gets the amateurs organized . . . Well, yes, but if they ever find out how, I wish they'd let me know. Since the League has taken on the air of a big business they've lost a lot of support. They'd really have to get a fire going to rally support now with the deadline so near . . . special newsletter editions . . . straight talk . . . and a lot of other people-to-people things that haven't happened in a long long time. You know, Bill, that's it, that's the trouble. Every night just as I begin to fall asleep, I think of 20282 and bust out laughing. If maybe I thought about the League organizing amateurs again and putting some real pressure on me, maybe . . . just maybe I could worry myself to sleep.

William J. Howard K1LNJ/3
Fort Meade MD

amsat

W3GEY (l) and DJ4ZC (r) discussing Oscar 8 at the March 22, 1975 AMSAT Experimenters meeting. DJ4ZC designed and built the 432 to 145 transponder on Oscar 7, and W3GEY did the final integration. (Photo by WB4IWF)

Oscar 6 Orbital Information				Oscar 7 Orbital Information				
Orbit	Date (July)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (July)	Time (GMT)	Longitude of Eq. Crossing °W
12376	1	0002.4	51.1	B	2848	1	0024.2	55.9
12389	2	0057.4	64.8	AX	2861	2	0118.4	69.5
12402	3	0152.4	78.6	B	2873	3	0017.6	54.3
12414	4	0052.3	63.6	A	2886	4	0112.2	67.9
12427	5	0147.3	77.3	B	2898	5	0011.4	52.7
12439	6	0047.2	62.3	A	2911	6	0105.5	66.3
12452	7	0142.2	76.0	B	2923	7	0005.1	51.2
12464	8	0042.1	61.0	A	2936	8	0059.3	64.7
12477	9	0137.1	74.7	BX	2949	9	0153.5	78.3
12489	10	0037.1	59.7	A	2961	10	0053.1	63.1
12502	11	0132.0	73.5	B	2974	11	0147.3	76.7
12514	12	0031.6	58.5	A	2986	12	0046.5	61.5
12527	13	0126.5	72.2	B	2999	13	0141.0	75.1
12539	14	0026.5	57.2	A	3011	14	0040.2	59.9
12552	15	0121.5	70.9	B	3024	15	0134.4	73.5
12564	16	0021.4	55.9	AX	3036	16	0034.0	58.3
12577	17	0116.4	69.6	B	3049	17	0128.2	71.9
12589	18	0016.3	54.6	A	3061	18	0027.4	56.8
12602	19	0111.3	68.4	B	3074	19	0121.6	70.3
12614	20	0011.3	53.4	A	3086	20	0021.2	55.2
12627	21	0106.2	67.1	B	3099	21	0115.3	68.7
12639	22	0006.2	52.1	A	3111	22	0014.5	53.6
12652	23	0101.1	65.8	BX	3124	23	0109.1	67.1
12664	24	0001.1	50.8	A	3136	24	0008.3	52.0
12677	25	0056.1	64.5	B	3149	25	0102.5	65.5
12690	26	0151.0	78.3	A	3161	26	0002.1	50.4
12702	27	0050.6	63.3	B	3174	27	0056.3	63.9
12715	28	0145.5	77.0	A	3187	28	0150.4	77.5
12727	29	0045.5	62.0	B	3199	29	0050.0	62.4
12740	30	0140.4	75.7	AX	3212	30	0144.2	75.9
12752	31	0040.4	60.7	B	3224	31	0043.4	60.8

Looking West

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

HAWAII IS GETTING THE WORD OUT! Such is the information furnished to me by Bill KH6IAF/6. The word I talk about is that of letting the general public know what we are, who we are and what we have to offer to them.

Sitting directly below a reprint of my Hotline blurb titled, "CBers Advertise on TV" in the March issue of the Honolulu Amateur Radio Newsletter (and Hotline expresses its thanks for the credit line), was the following article: "We're doing something about it . . . Hawaii Ham Forum . . . a monthly public affairs broadcast by HARC." It continues: "Accepted for public affairs airing on the following stations. Times will be announced at the March general meeting, and will be published in subsequent issues of the Bulletin. Stations carrying this program are KLEI, 1130 kHz, 10,000 Watts, Kailua, Hawaii (at press time KLEI informs us it will be on Wednesday nights, thus available to the far flung parts of the Pacific on skip) and KTUH, 90.3 MHz FM, located at the University of Hawaii, Manoa (also translator station K209AA, 89.7 MHz, Kahala to Hawaii).

Guests on the first edition of "Hawaii Ham Forum" were Richard Kimitsula KH6DVT, Dave Dengler of the Bulletin staff, and Russell Roberts, a non-ham of the Leward Community College faculty, to question Richard about ham radio from the public's point of view. This program is intended to inform the public and improve the image in the local community. It is not meant for hams only. Therefore, many questions will seem redundant to seasoned radio amateurs. Remember . . . it's for the "general public." As one of those interested in promoting such public information programs, I wish to compliment the members of HARC for showing the rest of us that such ideas are not beyond the reach of us all. All it takes is a little time, effort and a tape recorder to begin the basic effort. There is no reason why your club cannot follow the lead now set in Hawaii and achieve similar results. For those interested, HARC can be reached at: Honolulu Amateur Radio Club, c/o Jim Morris KH6HGQ, 197 19 Street, Hickam AFB, Hawaii 96553. A letter of compliment goes a long way in keeping such a worthwhile venture going. Now, how about the rest of you?

Sometimes, people become heroes when (and in ways that) they least expect. Such was the case for three of the users of the WR6ABE repeater system the evening of March 29. As related to me by Arnie Gamson K6PXA, here is what transpired. In the midst of an early evening "roundtable" on ABE, Lazlo WA6SWG broke the QSO to request aid for his boat that was stranded in the channel between Catalina Island and San Pedro Harbor. The weather had turned very bad, seas were choppy, and for some reason he could not reach the Coast Guard on his Marine Radio gear. His plea for assistance was answered immediately by Lou K6QWO, Ben W6WPT and Hap WA6WPP. Concurrently, Burt K6OQK, owner of ABE, requested a secure channel until the emergency had passed. Though communications were rough at times, Lazlo was able to describe his position and problem and in short order this information was passed on to Coast Guard Air Rescue. I am glad to report that thanks to the quick action on the part of QWO, WPT and WPP, this story has a happy ending. The Coast Guard located Lazlo and the necessary aid quickly arrived.

According to Bill KH6IAF/6, who also joined us in this late night QSO, and unlike yours truly, does have considerable experience aboard boats, the quick action taken by Hap, Lou and Ben most probably saved the lives of those aboard the stricken craft. With this thought in mind, I ask you this: "What better public service can we amateurs render than to be there when we are needed and be willing to help?" To me, that's what our hobby is all about, and Lou, Ben and Hap are prime examples. In my eyes, they deserve the tag "hero."

A call from Stu WB6HEE last night reported that he and Ed WA6YVX have completed final work on their San Diego based autopatch system, and are presently testing same on an inverted split-split channel of 147.285 in, and 147.885 out. Stu projects a 30 day test period after which the system will go into full time operation. With 250 members in the sponsoring organization, this will probably be the largest free-access open autopatch system in the country. Hopefully, we will have some pictures in a forthcoming issue . . . hint-hint Stu.

Pete WA6UEE is into an interesting project, WR6AIW by name. Unlike other systems, though, Pete's project will not be found on the air on a regular basis. WR6AIW is a portable repeater designed specifically to provide communication for another hobby, that of "Off Road Racing." Pete's black box was successfully smoke tested the weekend of January 31 from Black Peak, Arizona, providing communication for the Score-sponsored Parker 400 race. The system sat at 1700' HAAT, and provided coverage for about 60 miles over low mountains on .16 – .76. Operation was from noon on January 31 to 8 am on February 2, and proved that portable systems of this type are not only an aid, but can also be a major safety factor in coordinating events of this nature. Next big test for AIW will come with the well known Baja 1000 later this year. Pete, you done a good job.

A couple of notes on new or proposed systems in this area. There is now an open autopatch system currently testing here in the SF Valley area. At present WR6AJP is operating on a rather odd channel pair of 147.525 – 146.505 without SCRA sanction, but talk on the air hints that they may soon move to another channel pair in the near future. At this time, this is the only information I have other than the fact that AJP has one "wicked signal" here in the Valley.

I have also heard that there may be a 450 MHz open or semi-open (published PL frequencies). The callsign will be WR6AJO and talk is that it will be located atop Mt. Wilson. I have no information as to whether the above is accurate and if so, when this system will begin operation or on which channel pair it will be. As information becomes available, I will pass same along.

If the EIA plans to continue pushing for Class E CB on 220 MHz, they're going to have one hard time implementing it out here. 220 is really beginning to boom out here with new systems coming on the air every week. Bill WA6DVG hopes to have his 223.34 – 224.94 system operational

from atop Mt. Wilson in the near future on a regular basis, and PARC is in the process of getting its 220 version of WR6ABB into operation now that the new two meter Micor is up and working. WR6AER, LA's second 220 system, is still the busiest of them all, and now has begun to revive an old VHF tradition: the weekly T-Hunt. Saturday mornings, those interested in locating the elusive hidden transmitter get together at the AER site, Bill WA6NTW's house on "AER Mountain", at about 11 am. AER's output channel of 223.94 is used for the hunt and there are prizes awarded. Information concerning these T-Hunts can be had locally on WR6AER, 222.34 – 223.94, or on the Thursday evening Mt. Wilson Repeater Association News Program at 9 pm.

Amateur Radio Service-CARS, the experimental LAPD-Amateur Radio Cooperative program, wants to expand. To do so will require more LA amateurs interested in serving their community. Complete information on this program can be found in the March 21st issue of Hotline, and the program's directors have asked me to thank those from other parts of the country who have shown interest. Your letters will be answered. Those wishing to volunteer or those wishing information should write to Amateur Radio Service-CARS, PO Box 7302, Burbank CA 91504.

For almost a year now, I have been trying to find space to publish the following corrected information on the Stockton, California, .28 – .88 repeater, as furnished by Wally Wallin (its trustee), but with all that has transpired these past months, it was impossible to find the space – though I tried. However, I made myself a promise to do so this month regardless of what else came to pass, so here is the information. The correct callsign is WR6ACV and the repeater is located on the northeast slope of Mt. Oso in Stanilaus County, or, for those of you with maps, about 12 miles west of Patterson, California. From its 3,000 foot perch, it covers 39 counties in California and 3 in Nevada. The system is carrier access, open to all licensed amateurs, and boasts all Motorola equipment. The system is owned by the Central Valley VHF-FM Club, Inc., and is "affectionately called MOM (Mt. Oso Machine)". And Wally, this time we learned how to spell Stockton . . . hi . . . !

I find it impossible to close this month without a word or two addressed to some friends back East. The March 21st issue of Hotline heralded a story about the WR2ABK repeater being used to provide emergency police communication following a fire that wiped out telephone service in lower Manhattan last Feb. 27th. Prime motivating force behind this fantastic project was a New York City Patrolman, Andy Merendini WB2EIR. Andy and I go back many years – many, many years. In fact, I knew Andy way before he joined the NYC Police Department, and distinctly remember one evening when many of us waited breathlessly for Andy to emerge from the hospital, get on his mobile, and let us know if his first child was a boy or girl. It was a girl, Lisa by name, and you couldn't find two prouder parents than Andy and Mary. Andy and Mary were part of our unofficial group known as the Flying Amateur Radio Team back in the late sixties, and were always there to run the contests, go to the dinners or hold a party.

After reading the story in Hotline, I phoned Andy and taped a 15 minute interview that was used on the Mt. Wilson Repeater Assocation News Program that evening and has been the talk in public service ham circles out here since the Hotline article hit. Also mentioned in that article were two other close friends, Stu Seit WA2JNF and Jim Passione WA2ECP. I know these two guys quite well also, since they were two of the tech crew that made WA2ZWP (now WR2ACV) a reality. Therefore, along with everyone else, I want to add my congratulations to these three and to Mike WB2EIL and Bill WA2RXQ for doing what was needed at the moment it was needed. When the need was there, the people of WR2ABK were there, and their performance is a shining star in the world of Amateur Radio, our world!

. . . WA6ITF

BIG REWARD

The big companies in amateur radio today were, for the most part, started by one or two amateurs . . . and many grew very rapidly as a result of the low ad rates in 73 and the wide circulation among active (buying) hams. We'll give you 10% of the first ad run by a new company if you let us know about them and they advertise first in 73. Do yourself and the new firm a big favor – drop a note to 73 Advertising, Peterborough NH 03458.

NEW PRODUCTS

DENTRON TESTED

Old timers still spin yarns about the finest ham band we ever had. It's one you won't find on your transceiver, in all probability, though it's still there, providing a lot of enjoyment for the fellows who know about it.

This is what is known in England as Top Band . . . 160 meters . . . and it has several sterling advantages. First of all, 160 comes into its own during the low sunspot years . . . where we are right now. Secondly, since it isn't on all those transceivers, you don't have all that QRM you run into on 75 meters and the higher bands.

How do you get on 160 . . . easily? Lucky you asked . . . it seems that Dentron has figured this all out for you and has made available their model 160 XV transverter. This gadget takes the 80m output of your sideband transceiver and converts it down to 160m. It converts the received signal back up to 80m. The XV is self powered (120/220 V, 50/60 Hz). It's designed to match a 50 Ohm antenna. If you want to hook on something else you'll want to look into the Dentron antenna tuner.

The XV runs 100 Watts input with 5 Watts of drive – it is protected against over drive – so you have a substantial signal.

Give 160m a try – it's a great local band during the daytime and at night you can work out quite a ways. W1BB has been plugging away at getting DX stations down to 160 for a long time, and he's brought a lot of great DX to the band. The 160 XV sells for $199.95 postpaid from Dentron, 2100 Enterprise Parkway, Twinsburg OH 44087. It's built like a battleship – first rate construction. And be sure to listen for the 73 gang when you get on there . . . okay?

REPEATER UPDATE

ALABAMA			
*WR4AMM	Selma	146.13	146.73
*WR4AMM	Selma	444.50	449.50
ARIZONA			
*WR7ABR	Flagstaff	146.22	146.82
†WR7AEL	Kingman	146.16	146.76
†WR7AEL	Kingman	146.34	146.94
*WR7ABS	Phoenix	146.04	146.64
D–WR7ABS	Phoenix	449.30	445.30
*WR7ABQ	Phoenix	449.30	445.30
D–WR7ABR	Phoenix	146.04	146.64
†WR7ACC	Phoenix	52.76	53.76
*WR7AFC	Phoenix	147.60	147.00
D–WR7ABL	Phoenix	147.60	147.00
*WR7	Tucson	147.69	147.09
*WR7ABH	Tucson	146.34	146.94
†WR7ABM	Tucson	146.22	146.82
*WR7	Tucson	147.69	147.09
†WR7ABH	Tucson	146.34	146.94
CALIFORNIA			
*WR6AJB	Santa Cruz	146.19	146.79
COLORADO			
*WRØAES	Colorado Springs	146.37	146.97
CONNECTICUT			
*WR1ACY	Glastonbury	147.69	147.09
†WR1AEX	New London	146.34	146.94
FLORIDA			
*WR4ABN	Palm Beach	146.28	146.88
ILLINOIS			
D–WR9ADJ	Bloomington	146.04	146.64
*WR9AET	Chicago	222.02	223.62
*WR9	Libertyville	146.01	146.61
*WR9AES	Rockford	146.01	146.61
INDIANA			
*WR9ADJ	Bloomington	146.04	146.64
*WR9ABJ	Hammond	147.60	147.00
*WR9ABJ	Hammond	223.22	224.82
*WR9AEU	South Bend	146.13	146.73
IOWA			
*WRØAGC	Denison	146.28	146.88
†WRØAHO	Mason City	146.16	146.76
†WRØAHH	Waterloo	146.22	146.82
KANSAS			
*WRØ	Topeka	146.07	146.67
KENTUCKY			
*WR4AHV	Louisville	146.01	146.61
MAINE			
†WR1ACI	Bangor/Holden	146.34	146.94
*WR1	Dedham	146.31	146.91
*WR1AFC	Rockland	146.39	146.99
*W1PMR	Sugarloaf Mtn	146.16	146.76
MARYLAND			
†WR3ADZ	Jessup	146.16	146.76
MASSACHUSETTS			
*WR1AEW	Attleboro	147.93	147.33
*WR1AFO	Belmont	146.34	146.94
*WR1AEZ	Chestnut Hill	145.55	147.55
*WR1AER	Fair Haven	146.055	146.655
D–WR1ABZ	Holliston	146.385	146.985
D–DL2AA/1	Medway	147.81	147.21
†WR1AEY	Mt. Greylock	146.31	146.91
†WR1AEY	Mt. Greylock	52.78	52.525
D–WR1ACX	Somerville	146.145	146.745
*WR1AFG	Worcester	146.34	146.94
MICHIGAN			
D–WR8AEC	Detroit	147.96	147.36
*WR8	Ionia	146.01	146.61
MINNESOTA			
†WRØAGG	Waseca	146.94	146.46
MISSISSIPPI			
*WR5AIG	Oxford	CLOSED	
MISSOURI			
†WRØAJA	Warrensburg	146.28	146.88
NEVADA			
*WR7ACW	Reno	146.34	146.94
NEW HAMPSHIRE			
†WR1AEQ	Manchester	CLOSED	
NEW JERSEY			
†WR2ABJ	Cedar Grove	147.78	147.18
*WR2AGV	Elizabeth	147.885	147.285
†WR2ADV	Paramus	146.19	146.79
*WR2AGZ	West Orange	147.415	146.415
NEW YORK			
*WR2AGI	Armonk	147.615	147.015
D–WR2AGH	Owego	146.16	146.76
*WR2AJH	Rockland County	147.765	147.165
*WR2AGH	Tioga County	146.16	146.76
NORTH DAKOTA			
*WRØAEL	Minot	146.16	146.76
OHIO			
*WR8AGN	Cincinnati	CLOSED	
†WR8AEA	Cincinnati	147.69	147.09
†WR8ADX	Cincinnati	147.75	147.15
*WR8ACC	Cincinnati	146.16	146.76
*WR8ADW	Cincinnati	147.99	147.39
D–WB8COS	Cincinnati	146.16	146.76
*WR8AFG	Cincinnati	147.66	147.06
D–WR8ABP	Cincinnati	147.78	147.18
D–W8AIC	Columbus	146.34	146.76
D–W8WTB	Columbus	147.66	147.06
*WR8AES	Columbus	147.66	147.06
D–WR8ABR	Columbus	146.31	146.91
*WR8AEJ	Columbus	146.31	146.91
D–WB8NWE	Delaware	146.37	146.97
*WR8AGI	Louisville	147.72	147.12
D–WR8AGO	Nelsonville	147.72	147.12
*WR8AGQ	Nelsonville	147.72	147.12
*WR8AGC	Warren	CLOSED	
OREGON			
*WR7AFA	Eugene	146.28	146.88
D–WR7ADD	Mary's Peak	146.22	146.82
*WR7	Sutherlin	146.16	146.76
PENNSYLVANIA			
*WR3ADU	Acme	146.04	146.64
*WR3AEM	Exton		
*WR3AET	Greensburg	146.10	146.70
*WR3ADF	Hazleton	146.07	146.67
†WR3ADK	Pittsburgh	146.01	146.61
†WR3AEZ	Pittsburgh	146.28	146.88
†WR3ADN	Pittsburgh	146.37	146.97
†WR3AFQ	Pittsburgh	146.07	146.67
D–WA3BJS	Pittsburgh	146.16	146.76
†WR3ADG	Washington	146.19	146.79
RHODE ISLAND			
*WR1AFA	E. Providence	146.235	146.835
TEXAS			
*WR5AHA	El Paso	146.19	146.79
*WR5ACR	Fort Worth	147.81	147.21
†WR5ABR	San Antonio	146.13	146.73
VIRGINIA			
*WR4AII	Woodbridge	147.84	147.24
WASHINGTON			
*WR7AEP	Spokane T1950	146.13	146.73

CANADA

ALBERTA			
*VE6WQ	Edmonton	146.46	147.06
D–VE6WQ	Edmonton	146.46	147.00
*VE6HM	Edmonton	146.46	147.06
ONTARIO			
*VE3TAR	Cobalt	146.34	146.94
D–VE3TAR	New Liskeard	146.34/146.46	146.46
*VE3NFM	North Bay	146.34	146.94
QUEBEC			
*VE2MRC	Montreal	147.72	147.12

OVERSEAS

AUSTRALIA			
*VK4WIG/R1	Gold Coast	146.10	146.70
*VK2RAN/R2	Newcastle	146.30	146.90
*VK2RAB	Tamworth	146.25	146.85
*VK2RAO	Central West	146.10	146.70
*VK2RAS	Sydney, No.	146.40	147.00
*VK2	Sydney, So.	146.20	146.80
*VK2AMW	Wollongong	146.25	146.85
*VK	Canberra	146.30	146.90
*VK3RAM	Bendigo	146.20	146.80
*VK3WI/R1	Melbourne	146.10	146.70
*VK3RAG	Geelong	146.40	147.00
*VK3RAB	Latrobe Valley	146.20	146.80
*VK3RMW	Western Victoria	146.10	146.70
*VK7RAA	N. E. Tasmania	146.40	147.00
*VK5RAD	Adelaide	146.40	147.00
*VK6RAA	Albany	146.20	146.80
*VK6RAP	Perth	146.10	146.70
GUAM			
*WR6AJH	Agana	146.34	146.94

† = Change
D = Delete
* = New

LETTERS

SEALS OF MERIT?

The editorial by Wayne Green, in the April issue, prompts me to renew my subscription to your magazine.

I agree with what he said about the ham exams. If an automobile license entailed an examination comparable to the ones for the amateur General and higher classes, only mechanics would have cars — and no repair business. Come to think of it, Grandma wouldn't have been able to drive the old "oat-burner" either.

I don't believe that the code requirement should be abolished because code IS ham radio. I do believe, however, that the code speed for the General ticket should be reduced to ten words per minute with, perhaps, an opportunity to earn "seals of merit" for increased speed (over 10 wpm) to attach to one's General license.

A renewable Novice license would seem to be in order. Not all who pass the Novice exam are able to get on the air immediately to take full advantage of the two year period. To remove a Novice from the air for one year if he hasn't obtained a General license is just what he *doesn't* need. Much of what he has gained may be lost during this time, including his interest. His pocketbook may also be leaner as a result of his having taken up a "hobby" which, by definition, isn't.

S. B. Groenier
Madison WI

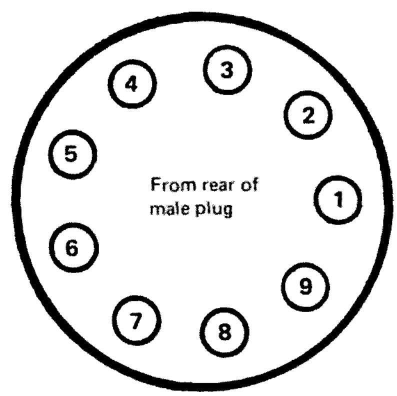
IC-230 CONT.

I have read with great interest the article in your May 1975 issue by Paul Bunnell dealing with changing the IC-230 for 15 kHz spacing. The article came out just in time for me as I was about ready to order a crystal for my IC-230 to be able to use a new autopatch repeater in my neighborhood.

To my dismay I was unable to use WA6VJR's table, as he followed the ARRL adopted Modified Texas Plan and here in Southern California we are using the MWRA Inverted Split-Split plan supported by the SCRA.

With the help of my SR 10 calculator it took but a few minutes to jot down the LO and CO crystals necessary to get complete 15 kHz coverage for 146.025 to 146.655 and from 147.345 to 147.975. See attached list.

Owners of early IC-230's were able only with great difficulty to read from the schematic just what the output was from the accessory socket. So maybe now would be the time to show the configuration.



PIN			
1	Discriminator	6	MIC
2	+9 V	7	VFO
3	+13.8 V	8	Ground
4	PTT	9	C.O. – Out
5	Detector Output		

146 MHz

SELECTOR 100 kHz	10 kHz		
A	1	146.025	
	4	.055	
	7	.085	
	0	.115	
	3	.145	LO Crystal
	6	.175	13.7844 MHz
	9	.205	Position 8
	2	.235	
	5	.265	
	8	.295	
	C	.325	
B	1	146.355	
	4	.385	
	7	.415	
	0	.445	LO Crystal
	3	.475	13.8211 MHz
	6	.505	Position 9
	9	.535	
	2	.565	
	5	.595	
	8	.625	
	C	.655	

147 MHz

SELECTOR 100 kHz	10 kHz		
A	1	147.345	
	4	.375	
	7	.405	
	0	.435	
	3	.465	LO Crystal
	6	.495	13.9311 MHz
	9	.525	Position 10
	2	.555	
	5	.585	
	8	.615	
	C	.645	
B	1	147.675	
	4	.705	
	7	.735	
	0	.765	LO Crystal
	3	.795	13.9678 MHz
	6	.825	Position 11
	9	.855	
	2	.885	
	5	.915	
	8	.945	
	C	.975	

CO Crystal 11.565 MHz

Late model IC-230's, I understand, have this information included in their manuals.

Mike Maurer WA6BMK
N. Hollywood CA

FREEBIE

As a magazine collector, I would like to put my ever-growing collection to better use than taking up space. I'll be glad to provide any reader photocopies of any article in any magazine available; there is no cost and return postage is not necessary. All issues of 73 Magazine, Popular Electronics and Electronics Illustrated, CQ from 1947, QST from 1921, and some issues of Ham Radio and others are available.

Donald Erickson SWL WPE6DIQ
6059 Essex Street
Riverside CA 92504

HALF RATIONS

The rise in cost of living, taxes, etc. (not to mention gasoline) seemed to indicate that a change in my manner of living was mandatory and that some of the luxuries would have to go — "73" was among the first to get chopped.

Somehow, it seemed, you didn't get the word as you continued to send the above-mentioned publication to my QTH and, as if that wasn't enough, you fired the shot that sunk me — your May cover. That did it — the

custom-built car, the handy talkie, the exquisite fur and the pretty dress with the beautiful stuffing in it, made me reach for my checkbook. But Wayne, before you become intoxicated with your success, let me say that *you* didn't make me change my mind — Miss Kelly did.

Yours for a bigger and better amateur radio,

Aloha Nui Loa, from the Bamboo American.

Walt Deiter KH6ANM
Kailua HI

P.S. You may be interested in knowing that, because of this, the XYL has put me on half rations for a week.

We have received many favorable comments on our lovely cover girl and wish to thank VHF Engineering for providing the photo -- Wayne.

PROFESSIONAL AMATEURS?

At the top of my FCC license, it says (among other things) Amateur Radio License. My Merriam-Webster Dictionary defines "Amateur" as follows:

"AMATEUR — One who cultivates a particular pursuit, study, or science, from taste, without pursuing it professionally — One practicing an art without mastery of its essentials. One with a taste or liking for something rather than an expert knowledge of it."

Now I ask you, what in the h - - - is the FCC trying to do to us? Make everyone a Professional Amateur, or an Amateur Professional?

The defense rests - - -

Bob Wiles WØDLL
1476 Prospect Drive
Loveland CO 80537

TURNING OUT TESTERS

Thanks for 73 — and especially such articles as "The Violet Tester" and the "What Have I Done" box.

I thought "The Violet Tester" would be an appropriate Mother's Day gift — expanded to my mother and mother-in-law. Then my neighbor (also a ham) joined in and so did several others at the office.

As of this date I have built 7 Violet Testers and supplied 11 additional "kits"!

The "What Have I Done" box is different — it didn't work. I changed the .01 to a .1 uF to get freq. down to audible, and after wondering for a day or so why the SCR wouldn't latch, I added a 1kΩ resistor across the osc. ckt. (It shuts off ea. cycle it seems, allowing the SCR to reset.) With those changes it works fine.

Will Rassbach WA7GRN
Seattle WA

additions and corrections

• I have recently received a letter from C. Warren Andreasen WA6JMM, PO Box 8306, Van Nuys, California, concerning one of my articles in the May issue, "AC Power for the HW-202" (p. 79).

He presented a very legitimate correction concerning this article. With two 2N3055 pass transistors in parallel, one of the transistors would "hog" all of the current. My particular supply shows both of the transistors in parallel although, due to the current capability of the 2N3055s, one can easily handle the current demand of the HW-202.

By placing a 10 Ohm resistor in both base leads or by placing a .25 Ohm resistor in both emitter leads of the 2N3055s, the current demand would be balanced between the 2N3055s.

I wish to thank Mr. Andreasen for his well taken correction.

Warren L. MacDowell W2AOO
East Amherst, New York

Look for WA6JMM's Touchtone Sequence Decoder in an upcoming issue of 73. — Ed.

• *"Fat Nixies for Chronometer Nuts", W2AOO, May, 1975, p. 23.*

K3JJO, among others, noted that the 1 meg resistors which one of our draftsmen inadvertently shorted out (Fig. 2, p. 24) may lead to a bit of a smoke problem. Not as much as was seen after Wayne hit the Art Department, Waldo!

• *"Me Friend", W7IDF, June, 1975, p. 17.*

Ken Cole, in his assiduous endeavors to locate DL1CU, publisher of the unique "Ham's Interpreter", has tracked his prey as far as the DARC — with no luck. The Ole King now prays for assistance from *lieber* OM's around the world, who might send him a note if they run into DL1CU on the air and can get his current address. *Gute Jagd!*

• *"The Minirepeater", WB4DBB, June, 1975, p. 55.*

Page 56, col. 1, line 4 — "two channel *unit*." Page 57, Fig. 2 — The audio test point should be labeled "4". Page 60, col. 2, line 10 — "B3" should read "B+". Page 64, Fig. 7 — The asterisk refers to the caption's "Make this larger, etc."

A+ FOR THERESA

I thought you might like to see a photo of my 9 year old daughter, Theresa, and her social studies project for the fourth grade. The project earned her an A+ and gained some good exposure for amateur radio.

As you can see, the project consisted of a map, DX QSL cards and some newspaper articles about good things in amateur radio. Maybe other kids could do similar projects to promote goodwill for amateurs. Young hams could turn this type of idea into a science project with the use of LED devices and magnetic switches.

Wade Van Fair W4GIW
Doraville GA

Caveat Emptor?

PRICE – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

AN OFFER you can't refuse – BUYERS & SELLERS P. 54.

TWO PLASTIC HOLDERS FRAME and display 40 QSL's for $1.00 or 7 holders enhance 140 cards for $3.00 – from your Dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin, Tennessee 37066.

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester NY 14612.

FOUNDATION FOR AMATEUR RADIO annual Hamfest Sunday, 19 October 1975 at Gaithersburg Maryland Fairgrounds.

POLICE AND FIRE Scanner Special – Regency ACT – R – 10 H/L/U 10 channel 3 bands, combined ac/dc 10 free crystals included $169.00 prepaid, dealer inquiries invited, Four Wheeler Communications 10-F New Scotland Avenue, Albany NY 12208.

JIG SAW PUZZLES wanted. If you have any old wooden jig saw puzzles in your attic – or run across them at an auction (they go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck apiece for them. c/o 73 Magazine, Peterborough NH 03458. Wood, not cardboard – and complete.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945-75. Indispensable!)

HALL OF FAME HAMFEST and auction rain or shine, Aug 3, 1975, Canton, Ohio. Come to Canton for football's greatest weekend. Saturday's activities – parade, enshrinement, NFL game Cincinnati vs Washington. Sunday – hamfest and auction at Stark County Fairgrounds. Main prizes – ICOM 230 – Hallicrafters FPM 300 – Standard 2 mtr hand held. Motel and camping space available. Call WF8HOF 146.19/79 or 146.52/52. Further information write WA8SHP, 73 Nimishillan St., Sandyville, Ohio 44671 or call W8SWB (216) 455-4449.

WILL TRADE: My $170 for your unwanted working HF XCVR, W/PS if possible. Bill Seibt, Box 33, FPO Seattle 98790.

RADIO SOCIETY of Ontario 1975 convention hosted by the Ottawa Amateur Club at the Skyline Hotel, Ottawa, Canada, October 3rd, 4th and 5th. For information contact P.O. Box 8873, Ottawa, Canada K1G 3J2.

SELL GONSET GSB-2 SSB transceiver matching ac supply speaker 144-148 MHz: $190 or best offer. New 5 element FM Yagi portable: $8. Cesco S.W. reflectometer model CM-52: $7. Good coax RG58U 100 ft: $5. All shipping postpaid. George Konnick, Apt. P-2, 1750 West Main Street, Riverhead, New York 11901.

HT-200 HANDITALKIE Gud shape on 94 and 147.99-39, 2 battery, home-bru-charger, rubber ant. $200.00. Bob Sumption K9VYE, 142 E. Murray St., South Bend, Indiana, 272-4832.

REGENCY floor models and demos at big savings! Full factory warranty. HR2B $229 now $199.99, HR2MS $319 now $289.99, HRT2/nicad $229 now $199.99, HR212 $259 now $229.99. Add $3.50 per unit for shipping and handling. VEGAS RADIO, 1108 So. 3rd, Las Vegas NV 89101.

FREE: 8 EXTRA CRYSTALS of your choice with the purchase of a new ICOM IC-22A at $249. With the 10 crystals which come factory installed in the IC-22A, this gives you a total of 18 crystals! For equally good deals on Kenwood, Drake, Ten-Tec, Collins, Swan, Atlas, Midland, Standard, Regency, Tempo, Alpha, Genave, Hy-Gain, CushCraft, Antenna Specialists, Hustler, Mosley, and others, write or call HOOSIER ELECTRONICS, your ham headquarters in the heart of the Midwest, and become one of our many happy and satisfied customers. Hoosier Electronics, PO Box 2001, Terre Haute, Indiana 47802. (812) 894-2397.

FOR SALE – HEATHKIT SB104 with N/Blanker and HP1144 power supply mint condition – $925.00 – FPM 300 transceiver with blower & mobile mount – $325.00. WB8GGM – 419-468-1438.

LENSES – Fit Robot and other SSTV or FSTV cameras, "C" mount, 1 inch, f2.5 regular; ½", F1.5 wide angle; 3 inch, f3.5 telephoto; all wollensak, all three for $150. Asa F. Tift, 3200 Trowbridge Road, Albany GA 31707.

FOR SALE. 4-400 tetrode tubes. Guaranteed. $20 each. K4KKW, 228 S E 43rd Ter., Cape Coral, Fla. 33904.

LOW & MEDIUM FREQUENCY RADIO SCRAPBOOK. Unique new handbook dedicated to the experimenter. Receivers, converters, coil winding, antennas, loops, the non-licensed communication bands and the FCC rules. Over 100 pages chock-full of diagrams and data. Nostalgia for the old-timers and an introduction to radio communications for the newcomer. $4.75, Cornell, 225 Baltimore Avenue, Point Pleasant Beach NJ 08742.

TECH MANUALS – $6.50 each: R-220/URR, SP-600JX, USM-159, GRR-5, URM-25D. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

MONTREAL HAMFEST 75, Aug 3, MacDonald College Farm, Ste. Anne de Bellevue, prizes, giant fleamarket, technical sessions, family fun $2.50/adult. Info contact VE2RM, Box 201, PointeClaire-Dorval, Quebec H9R 4N9.

Continued on page 112

Richard M. Smith W1FTX
RFD 2
Winsted CT 06098

Rare DX via Oscar?

Having completed OSCAR-style DXpeditions to PJ9, PJ7, VP2A and VP2L with a reasonable amount of success during the past two summers, I learned a few things that may be worth passing along to others who are contemplating similar travels to "rare and exotic" places.

When and Where?

One big difference between OSCAR DXpeditions and others is the fact that your operating schedule must be tailored to the availability of usable orbits of the satellite from wherever you plan to travel. At this writing, a very favorable situation exists, because both OSCAR 6 and OSCAR 7 are operational, so there are plenty of orbits available. However, if you are pressed for time, you may want to conduct a little research on how much operating time will actually be available based on the latest satellite operating schedule. You'll probably drive your travel agent completely wild trying to arrive at an itinerary that will produce the greatest amount of on-the-air time for the dollars you'll spend getting there! At present, Wednesday (GMT) is an OFF day for both satellites, and therefore a good day to travel! Midweek airfares are also usually cheaper than weekends. So the really serious minded DXpeditioner will plan his trip accordingly. When we only had OSCAR 6 available, and a battery-saving operating schedule was in effect, this took considerably more planning than I'd care to admit.

Another major factor in satellite DXing is selection of a favorable spot for the trip. In contrast to a low band DXpedition where worldwide propagation is a relatively safe bet, when you are thinking of OSCAR activity, bear in mind that (1) your maximum range will be about 5000 miles (with our present satellites), and (2) most of the OSCAR activity is concentrated in the USA, Canada, Europe and Australia/New Zealand, with growing activity in South America, Africa, Hawaii and Alaska. Therefore, consult the globe before you decide where to go. For US amateurs, the logical choice is the Caribbean area, because it is within range of the USA, western Europe, North Africa, and about two thirds of South America. The choice of one island *versus* another introduces a few other variable considerations such as ease of licensing, availability of local hams who are interested enough to want to help you, and the terrain of the island.

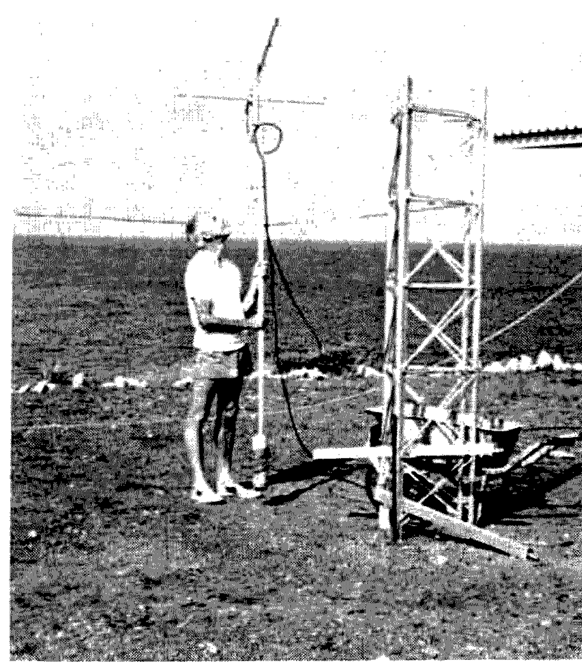
W1FTX operating at PJ7VL, St. Maarten, 1973.

In my limited experience, I've found that if you are planning to go to the Dutch islands, you should apply for your license *at least* four months ahead of time. My PJ9FTX license arrived nearly a month after I returned to the States, and it was only because I was traveling with W1BIH, who already held PJ9JT, that operation from Curacao was made possible. By contrast, licensing in St. Lucia is very rapid, and application can be made on the day of your arrival. All that is needed is your stateside license, a description of the equipment you plan to use and a fee of about $2.50 ($5.00 ECI). Licensing procedures vary widely from island to island in the Caribbean, however, and you would be wise to check with the ARRL for the latest licensing information, as soon as you decide on which island you want to visit.

The terrain of the island is also of greater importance for an OSCAR venture than for others. Many of the islands are very mountainous, with peaks rising to 2500-3000 feet right out of the ocean. Obviously, if such a peak should be in the path of your desired transmission to OSCAR, you'd have a very limited "window" and fewer QSOs would result. In general, if you are going to the Caribbean, try to find an operating site on the northern tip of the island, or, if not there, at a point sufficiently distant from the peaks that a reasonably low "horizon" exists. The National Geographic Society maps of the various islands will be of help here, because they usually show where the peaks are.

Another factor is the hotel accommodations available and whether they object to having operation from their premises. I have found that most of the hotels do not raise objections and are usually very cooperative, even to the extent of providing maintenance personnel to help in erecting antennas. It is advisable to check this out first by mail, however, before you start. I've found that a few words describing the specialized nature of your satellite experimentation goes a long way toward opening the door, both in the hotel and in licensing problems. Most of the local officialdom will not have heard much about OSCAR, but it is a fascinating story, and they will be quick to show an interest when you point out that your efforts may be a "first" from their island. If you can enlist the help of one of the local hams beforehand, as I did with PJ7VL and VP2LAW, this will also help in cracking any "ice" that officials may exhibit. The fact that one of their own hams is to participate makes it more palatable.

If you can't make advance arrangements with a resident ham, the local officials will sometimes introduce you to an active local ham who might be a likely candidate to help out. This was how I met Mickey VP2AR and



W1BIH aiming OSCAR antenna, at PJ9JT, Curacao, 1973.

his XYL Hya VP2AYL, who were most hospitable during my brief visit to Antigua in 1973.

Another consideration is what kind of commercial power is available. Some islands have 120 volt 50 cycle, others 220 volts. Fortunately, most of the hotels have an electric shaver outlet at 115 V ac available, but you should check this out in advance.

What Equipment?

The selection of equipment to take with you will be governed by your own tastes, but in some instances cooperative arrangements to use equipment already on the islands can be made in advance with one of the local hams. If you plan to operate from his station, this will lighten your load, but you may still need a license to operate, so check this too, in advance.

Usually, the local hams will not have any 2 meter or 432 MHz gear, so you'll have to carry it with you. Obviously, the lighter the better! I found an old typewriter case that could be used, after some slight modification, to carry my Ameco TX-62 transmitter (weight about 24 lbs.). The 20 Watts output of this rig was entirely adequate for OSCAR 6 use, but is marginal for OSCAR 7, Mode A, unless at least a 7 element yagi is used.

A 7 element 2 meter yagi was carried, knocked down, in a device resembling a golf bag made from a 4 inch diameter cardboard mailing tube. The tube was fitted with a carrying handle made out of scraps of twin

W1BIH and W1FTX operating OSCAR 6 from PJ9JT, Curacao, 1973.

lead. A metal coffee can was glued inside the tube to close one end of the tube and another one was used as a removable top. Carrying the antenna in the original carton (in which it came from the manufacturer) is not recommended, because the customs officials in some countries may think that you are trying to avoid duty charges on new equipment for sale to someone on the island. If the equipment is obviously not new, their fears are usually not a problem. I've had no experience with the 432 MHz to 2 meter translator in OSCAR 7, but from present reports, 10 to 20 Watts output coupled with modest antenna gain should be sufficient. The 7 element 2 meter yagi seems to be a good compromise between size and gain for use on the 2 to 10 meter translators in OSCARs 6 and 7. Good results have also been obtained by PJ9JT using a homemade 4 element 2 meter yagi. His signals were sometimes S8 to 9 in Connecticut. I would not recommend simpler antennas, unless the rig to be used is in the higher power range with output in the 100 Watt class.

The coaxial cable for the antenna will probably weigh more than the antenna itself. I found that a 50 foot length is probably the minimum you can get along with, and more is desirable if you can cope with the weight. (Don't count on coaxial cable being available on the island.) I chose the heavier RG8/u instead of RG58/u, because the lower loss factor of RG8/u at 145 MHz made it seem wise, in view of the fact that I was using a QRP rig. For a receiving antenna, a folded dipole cut for 29.5 MHz and fed with 75 Ohm RG59/u worked very well for me wherever I went. You will probably miss hearing some of the weaker stations with this antenna, but unless you are planning a fairly long visit, you won't have time to work everyone anyway. Obviously, if a 10 meter beam is available at the site, use it.

You can make up for some of the deficiencies of the folded dipole (*versus* the beam) by taking with you a transistorized 29 MHz preamplifier powered by a small 9 volt battery. The preamplifier is a must, unless you are going to be using a 10 meter receiver known to have excellent sensitivity at the 29.5 MHz downlink frequency. Most of the older receivers (even some of the high priced

W1FTX with VP2LAW holding OSCAR antenna, St. Lucia, 1974.

ones) are noticeably lacking in sensitivity at the high end of the 28 MHz range.

In the category of miscellaneous things to take with you, I'd suggest a ball of nylon twine for use in supporting the receiving antenna, various coaxial connectors and short lengths of coax, some lightweight tools, including a soldering iron, a dependable timepiece, a magnetic compass and of course, orbital data. If you know the latitude and longitude of the island, you can usually find someone on the AMSAT net* who can furnish rather exact orbital data including both azimuth and elevation figures from one of several existing computer programs. Another very valuable addition is a pair of headphones equipped with a long enough cable to permit the person who is aiming the antenna to hear what is coming in on the receiver.

Operating

Once you have armed yourself with a good set of orbital data and have worked out a reasonable installation, the fun begins. You will probably have given prior notice to other OSCAR users to be on the lookout for you. It is advisable to announce in advance what downlink frequency, or frequencies, you plan to use. A quick CQ will then usually bring an immediate pile up. The best way, in my opinion, to work the pileup, is to announce in advance (before you leave home) that you will not work anyone who calls on your own frequency, but that you will listen ± 5 kHz. This will stymie a few of the less experienced guys, but if they are smart they'll soon catch on and you will have a relatively clear frequency. A brief RST exchange is suggested, identifying the station you are working a couple of times at the beginning and end to compensate for fading and possible QRM. Exchanging names, QTH and weather data is not for OSCAR DXing!

After the first few days, the pileup will have subsided somewhat, and you will want to move around a bit on the band looking for some of the stations who have fixed operating frequencies. They will appreciate your efforts to move to their rockbound downlink signal.

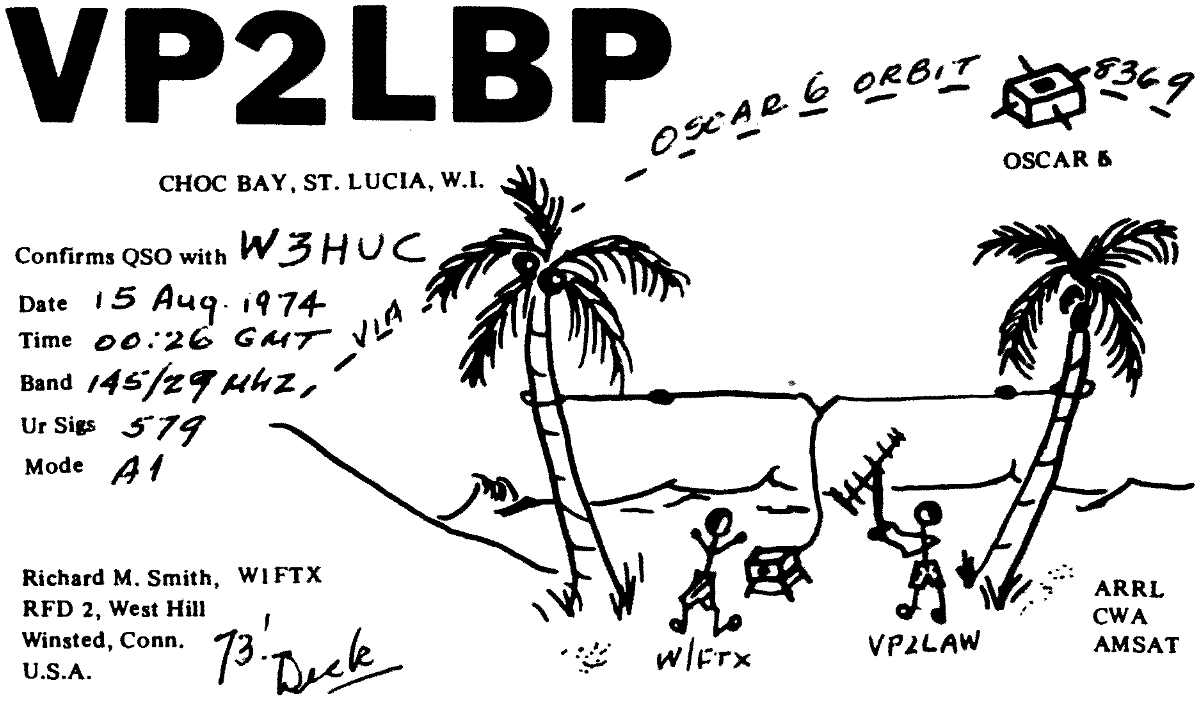
There will always be a few guys who are

*Wednesday – 3850 kHz at 0100 GMT for eastern USA, 0300 for West Coast; Sunday – 14280 kHz at 1800 GMT, 21280 at 1900 GMT.

not satisfied to work you only once. You can be accommodating and work them again, or not, as the mood strikes you. I tried merely acknowledging duplicate calls with a quick W - - - -, B4, meaning "you're in my log already, see you later," but sometimes they didn't understand. I can't fault them for wanting to be sure that they are in the log. Sometimes, in the heat of a pileup, there is enough QRM to make it less than certain that a two-way exchange has taken place, and you have to give the other guy the benefit of the doubt.

On north to south passes of the satellite, it will pay dividends to tune around a bit after the W/K stations have faded out. I worked PY2CSS and ZP5AY this way from VP2LBP. When I vfo'ed onto their frequencies, I think they got a mild shock when they heard me calling them. There is also activity in Argentina, Colombia, Venezuela and Peru; interest is also being shown in Chile, Ecuador and Bolivia. By the time this is in print, there may be even more activity in South America, so tune around.

Tracking the satellite, once you are armed with orbital data, is rather simple, but here's where assistance from another operator on the scene comes in. Most of my Caribbean DXing was done with the assistance of another person to do the antenna aiming. At PJ9JT, W1BIH was the other member of the team. At PJ7VL it was my XYL, at VP2LBP it was either John VP2LAW or John Purdy, an SWL. We would map out each orbit beforehand, placing markers (rocks) on the ground describing the arc of horizontal rotation required by the particular pass. One marker for each 3 or 4 minutes of the orbit was usually enough. We would also rehearse briefly the elevation required at each of the markers (the horizon at the start and finish, increased to a maximum of about "X" degrees above the horizon in the middle). This can be written down on a card which the antenna aimer can refer to, calibrated in minutes after the "go" signal. An added refinement, if the aimer can copy CW, is to equip him/her with a pair of headphones which are connected to the receiver. This gives the aimer exactly the information needed to keep the antenna tracking at the optimum. He can hear the returning signal from your rig, and knows that when the returning signal starts to get weak, some adjustment in the antenna aiming is needed. Actually, the pattern you get from a 7 or 4 element 2 meter yagi is broad enough in both the horizontal and vertical planes so that aiming is not at all critical. Another gimmick that might be useful is to change the polarization of the transmitting antenna from horizontal to vertical to see which is best. In general, vertical polarization seems



best at the start and end of a pass, when the satellite is near the horizon, and horizontal at other times. We even found that when working through OSCAR 6, it sometimes helps to cock the antenna 10 or 15 degrees away from horizontal or vertical. Not enough experience exists at this time to know whether the simple aiming technique we used for OSCAR 6 work will be equally effective for OSCAR 7. If you can't use the headphone "feedback loop," you can sometimes do the same thing by merely turning up the audio gain on the speaker to the point where the person aiming the antenna can hear what is going on. We used this to good advantage at PJ9JT, where the operating position was on a patio less than 40 feet from where the antenna aimer was standing.

One more slightly humorous note: While my XYL was doing her aiming chores during one daytime orbit at PJ7VL, one of the other guests at the hotel asked "Is your husband inside watching TV?" (The nearest TV station was on Antigua!)

. . . W1FTX

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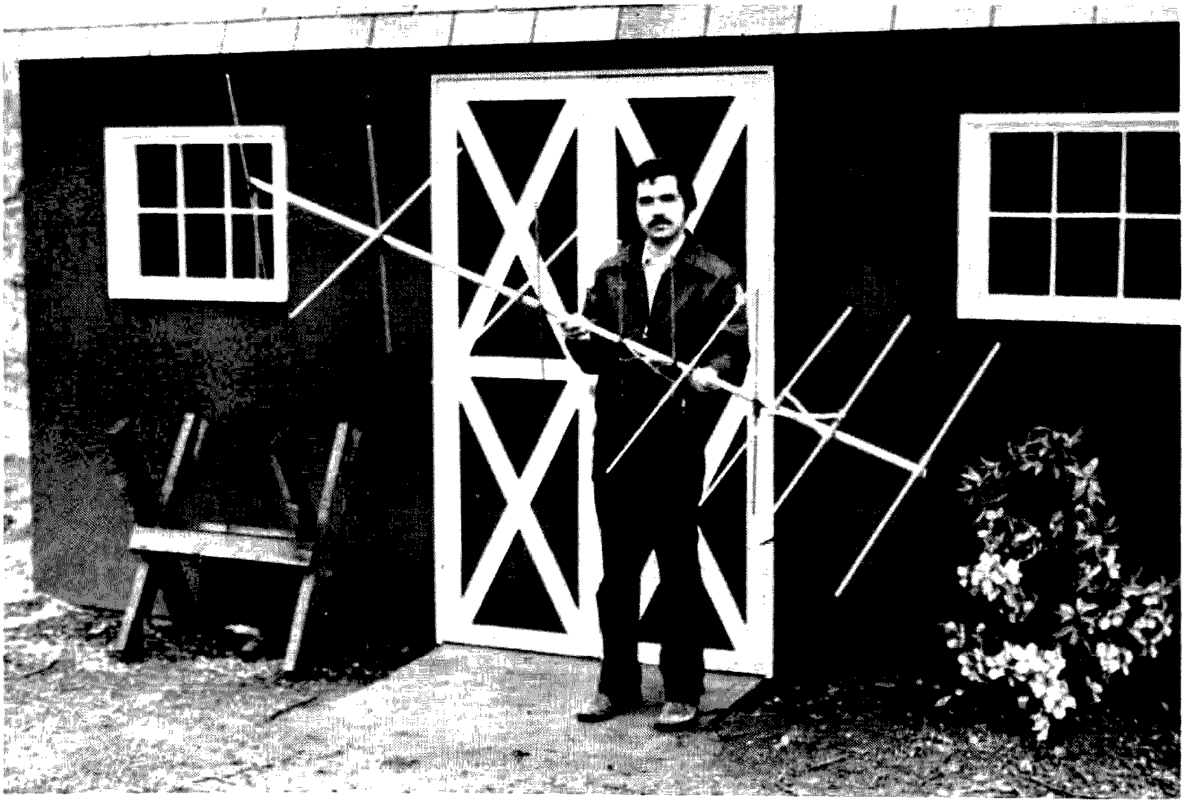
Antennas for Oscar - What really works?

Although mobile in motion contacts through AMSAT-OSCAR 6 have been accomplished with a simple two meter verticle whip, if you plan to make some contacts via satellite you should consider using some of the antennas mentioned in this article. You'll find that a good antenna system is the key to being a successful satellite operator.

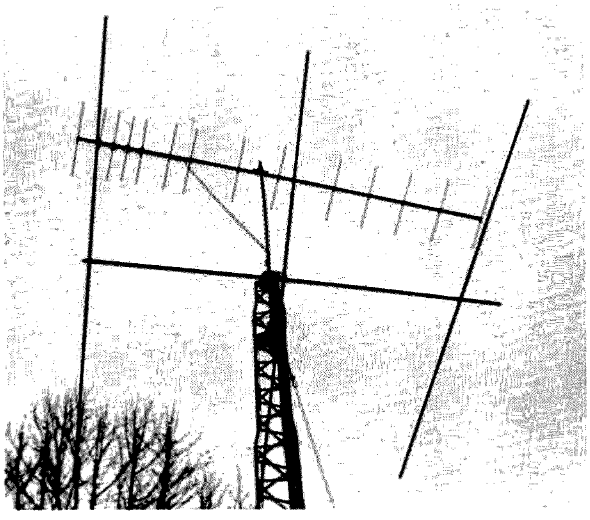
If you are just getting started in satellite communications, you will want to concentrate on antennas for ten and two meters and later on add something for 70 centimeters. AMSAT-OSCAR 6 uses two meters

The author with his four element CushCraft two meter beams at 30 and 60. A fourteen element KLM beam for 432 MHz is used for AMSAT-OSCAR 7.



The KLM six element cross-polarized OSCAR two meter antenna.

as an uplink and ten meters as a downlink. One transponder on AMSAT-OSCAR 7 uses this same combination while the second transponder uses 70 centimeters as the uplink and two meters as the downlink. These three bands are ideal with regard to antennas since antennas for these frequencies are (1) straightforward to construct, (2) easy to erect, and (3) economical to purchase.



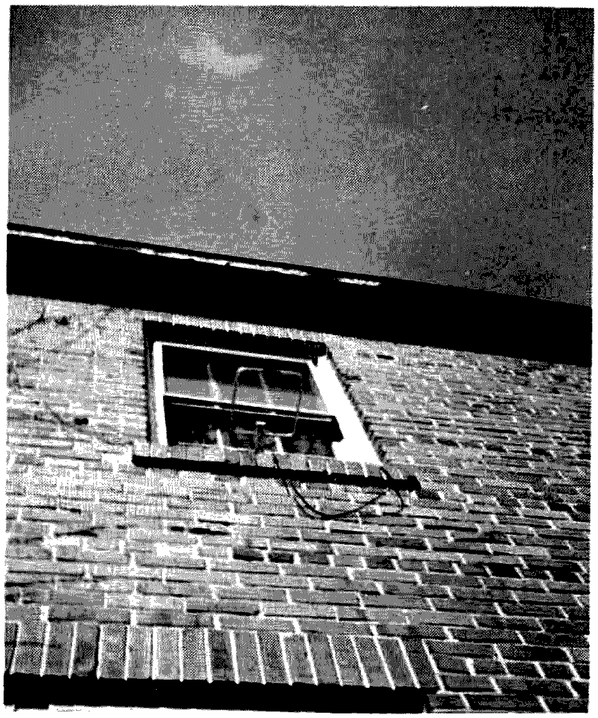
A three element beam for ten meters and a fourteen element KLM for two meters.

Your antenna choice will depend on several variables, such as cost, available space and transmitter power. But even lack of space shouldn't discourage you, as many fine stations operate through the satellites from apartments. This article describes several antennas that should help you decide which one you will want for your OSCAR station.

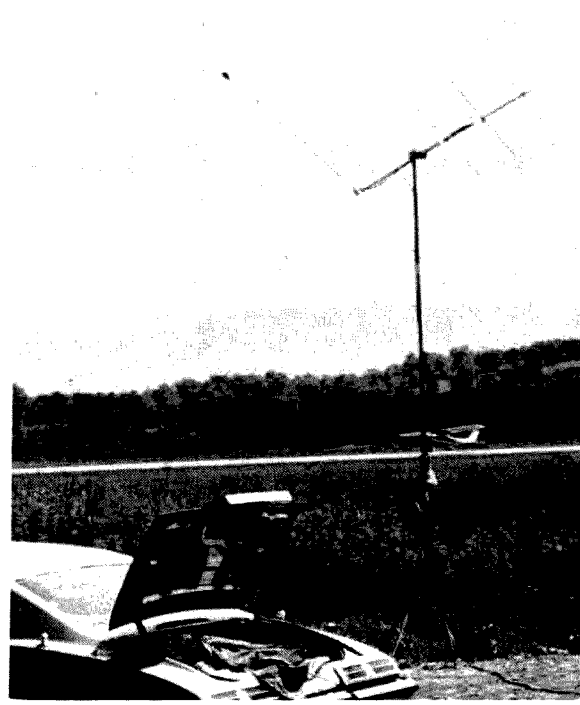
Standard Antennas

The two meter uplink for both AMSAT-OSCAR 6 and 7 requires approximately 100 Watts effective radiated power (ERP), made up of your transmitter power and the gain of your antenna less the feedline loss. Usually this calculation will indicate that an antenna with about 10 dB gain is needed. Because antennas with 10 dB of gain have a wide angle of radiated power, they are easy to keep aimed at the satellite. Thus, you will find that many active satellite users have two meter beams with from four to eleven elements.

One such antenna is the four element yagi by CushCraft, cut for FM use. It needs no modification and is very economical. Because the half power points are at 66°, you need only move the antenna every three or four minutes during a satellite pass. The

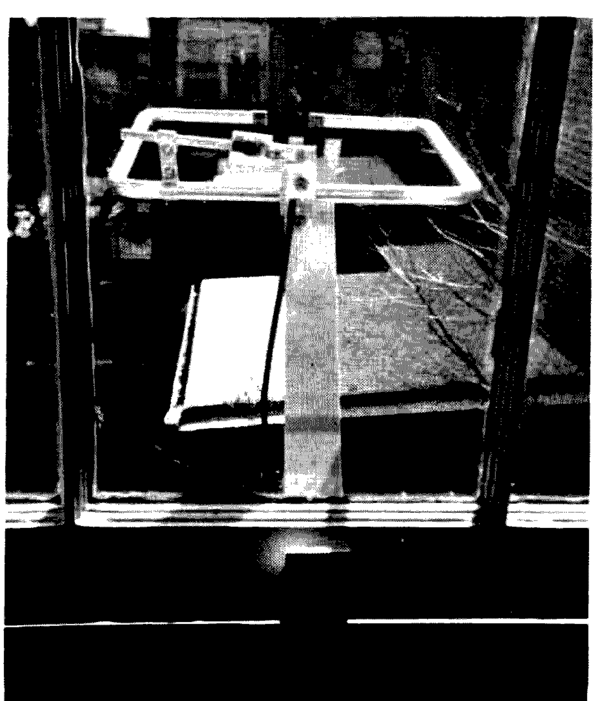


Squalo for two meter uplink at K2QBW/3.



W2GN/1 ten and two meter cross-polarized array.

photo shows two of these antennas in use, along with a fourteen element KLM yagi for 432 MHz. The four element beam at 60° elevation is used for overhead passes, while the second four element beam at 30° elevation is used when the satellite is lower in the sky. I find this combination of antennas more convenient than az-el control and very economical. When the satellite is on the horizon, I switch to the fourteen element KLM beam.



The apartment dweller's special – a two meter Squalo that disappears during the day.

For the ten meter downlink a simple dipole can be quite effective, especially on overhead passes. You can, however, increase the time period you can hear the spacecraft by several minutes by using a ten meter beam. The ten meter beam is very inexpensive and easily tuned to 29.5 MHz. Horizontal polarization is used, but vertical could also be used.

Of course, there are many other choices for you. I've also had excellent luck with a 16 element two meter collinear on AMSAT-OSCAR 6. A cross-polarized antenna specifically designed for satellite operation by KLM is also shown. If you already possess a tribander you're in luck – they are fine antennas for the ten meter downlink.

Small Antennas

Many amateurs who live in apartments find that they can't be successful on the high frequency bands because they can't put up large beams or dipoles. Fortunately, the

OSCAR transponders use VHF and UHF where antenna sizes are relatively small. Since it is effective radiated power (ERP) from your station that limits your ability to access the spacecraft, by increasing the transmitter power you can maintain the typical 100 Watts ERP required and still get by with a small antenna.

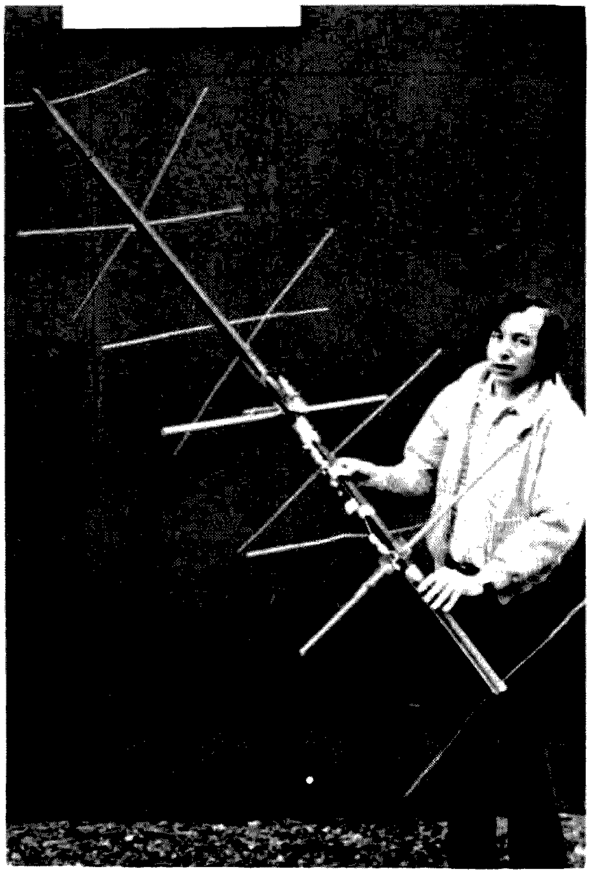
There are many two meter antennas designed for FM use that are well suited to satellite use. The four element two meter yagi by CushCraft is my favorite and should fit on an apartment dweller's outside balcony. Perhaps you could find a Squalo at a hamfest and mount it from a window. By mounting it under the window when you need it, your neighbors will never know you exist.

Small satellite antennas make fine construction projects because they can be completed in several evenings of work. An array built by W2GN is a three element cross-polarized two meter beam and a crossed dipole for ten meters. It was recently used at the Bennington, Vt. airport on one of the many expeditions W2GN has undertaken to put inactive states on the satellites.

Also shown is the W3TMZ homemade beam, which has been used in several demonstrations given by AMSAT members in the Washington, D.C. area. This five element cross-polarized two meter beam was built on a wooden boom using dimensions from the third edition of the ARRL VHF Handbook. By using ¼ inch aluminum clothesline wire for the directors and the reflectors, you should be able to keep costs below four dollars for the project. As simple as this antenna is, it allowed a group of AMSAT members to make eleven contacts on one pass during a recent demonstration.

Large Arrays

Many amateurs who have been active on the VHF bands, with large arrays for moonbounce, meteor scatter, etc., have become active on both AMSAT-OSCAR 6 and A-0 7 with excellent success. Of course, with large antennas it is very easy to overload the satellite's automatic gain control in the



W3TMZ with his inexpensive cross-polarized two meter yagi on a wooden mast.

W3TMZ inspecting his AMSAT-OSCAR 7 antennas – two fourteen element KLM beams and a fourteen element 432 MHz K2RIW yagi.

"Armstrong Baby," the best satellite antenna and rotor available.

receiver — so constant monitoring of the downlink signal is necessary.

Still, when you set out to work DX a second class station will just not do. One such multipurpose antenna system consists of two fourteen element KLM yagis for two meters and a K2RIW fourteen element yagi for 432 MHz. The elevation rotor is an Alliance U-100 with a HAM-M for azimuth control. With an array such as this and normal propagation conditions, you should be able to hear your return signal on ten meters with only a few Watts on overhead passes. However, it's when the satellite is on the horizon and you are looking for DX that you'll appreciate this antenna.

Conclusion

As you can see, there are many antennas that you can use to be successful on the two satellites now available for your use. My final recommendation, however, is the W4CKB special. On order, "Armstrong Baby" will point the antenna any direction requested. How many years have you wasted with just a HAM-M?

Reference

ARRL VHF Handbook, Third Edition, Two Meter Yagi, Figs. 9-27, page 190.

. . . W3HUC

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An Oscar Preamp that Works Wonders

Probably the greatest problem most amateurs have with obtaining satisfactory two-way communications via satellites is in hearing the ten meter downlink. If you are not able to copy the 29.45 MHz beacon on AMSAT-OSCAR 6 on an overhead pass or even passes that are somewhat removed from overhead, then your receiving system is not as good as it can and should be for satellite communications. Generally, most receivers' sensitivity is reduced considerably at 29.5 MHz for numerous reasons (poor noise figure, inadequate gain, and poor impedance match). A good antenna will help, but a low noise preamplifier will do more to improve the receiving system than an elaborate antenna system. Generally, most receivers have noise figures ranging from 8 to 20 dB at 29.5 MHz (a good guess). With a properly operating and designed preamp the noise figure can be reduced to 2.5 dB and 15 to 20 dB of gain can be realized. Such a preamp will improve the receiving system sensitivity greatly.

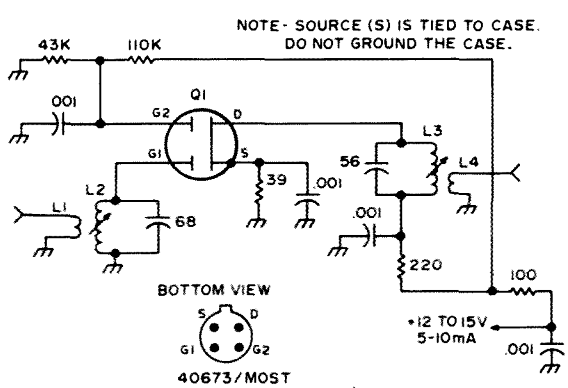

Fig. 1. Schematic. L1 – 2T No. 24E closewound over cold end of L2; L2 – 10T No. 24E spaced wire diameter, ¼" dia. slug tuned (RED); L3 – 10T No. 24E closewound, ¼" dia. slug tuned (RED); L4 – same as L1; Q1 – RCA 40673.

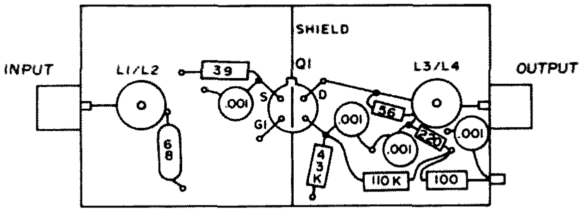

Fig. 2. Simplified component layout.

One important factor that must be dealt with now that the receiving system has been made super-sensitive is the susceptibility to overload, cross-modulation, etc. Unfortunately, this is almost always a problem with very sensitive receiving systems. This situation is even more profound with regard to OSCAR communications, i.e., simultaneous receiving and transmitting. Depending on the transmitters' operating characteristics (unwanted products) and proximity of the receiving/transmitting antennas, this problem will vary with each installation.

A number of preamps of the following design have been built. These have had measured noise figures ranging from 2.5 to 4.5 dB and power gains ranging from 15 to 22 dB. An absolute best design has not been attempted, but what has been built performs quite well.*

The layout of the components is not critical, but a shield partition across the device (dual-gate MOSFET) is desirable. Almost any dual gate MOSFET will work in this circuit. The devices that have protective diodes will have slightly poorer noise figures but they do offer good transient protection and are easy to use (3N187, 3N200, 40819, 40820, etc). The 40673 is normally priced at

*This preamp design has proven over several years to be almost totally immune to overload/cross modulation.

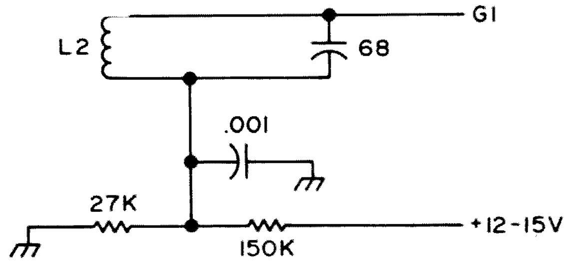

Fig. 3. Biased gate no. 1.

$1.01.

Using the coil/capacitor combinations shown in the schematic will produce a very low noise figure and excellent gain. In some cases it is necessary to reduce the gain of the preamp because the noise from it and the antenna will overload the receiver. Two simple methods of achieving this gain reduction are to add a pad (attenuator) on the output of the preamp or make a slight modification to the preamp by biasing gate no. 1 as shown in Fig. 3. The gain will decrease as G_1 is biased positively (6 V maximum).

REFERENCE

AMSAT Newsletter, March, 1973.

. . . W3TMZ

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Shoot Oscar with a Satellabe

Communication via Oscar satellites is, in principle, similar to conventional amateur operating procedure. In both cases, one calls or answers CQ, exchanges signal reports and other "vital" information, wraps up the QSO with a 73, and then tries to work somebody else. For communicating over long distances on VHF and UHF bands, large gain antennas are routinely employed. Because such antennas are characterized by a narrow beam-width, they must be accurately aimed toward the station sought.

While in ground-to-ground communications, directing the antenna towards the desired direction is not a particularly difficult task. In satellite work this matter becomes more complicated.

Let's review some of the problems encountered in satellite communications.

1) The large distance (912 to 3000 miles) between the spacecraft and ground station, and the QRP power of the translator, make high gain beams a necessity for Oscar communications, if consistent results are desired.

2) A satellite represents a "moving target" traveling with the velocity of 4 miles per second (14,000 mph), some 912 miles above the surface of the earth.

3) The satellite rises above the horizon several times a day for periods lasting from a few seconds to a maximum of 22 minutes, during which time it becomes available for communications. (Oscar is not accessible beyond the line-of-sight.)

4) The times the satellite rises and sets are different for each geographical location on the earth.

5) The elevation (vertical angle) of the spacecraft, in respect to the tracking station, may, during certain passes, change from 0° to 90° within a period of only 12 minutes. During the same time the azimuth (horizontal angle) may sweep an arc 180° wide.

The above points clearly imply that an Oscar user must follow the satellite with his high gain antennas to secure optimum performance. Consequently, he must know the position of the satellite in respect to his QTH at any time around the clock. This objective can only be achieved by employing some form of satellite tracking method.

The reference point for satellite tracking purposes is the time and longitude at the very instant the satellite crosses the equator from south to north. (The orbital constants of the spacecraft, period and inclination, must also be known.) Listings of Oscar 6 and Oscar 7 equatorial crossings, hereafter referred to as EQX, are published by Amsat, 73 and many other sources months in advance, and are, in general, easily available. Some listings include all daily EQX's, others provide that data for reference orbits only. A reference orbit is the first daily satellite pass which crosses the equator after 0000 GMT.

Once the EQX data becomes available to the Oscar user, it is left to his discretion how to employ it for tracking purposes.

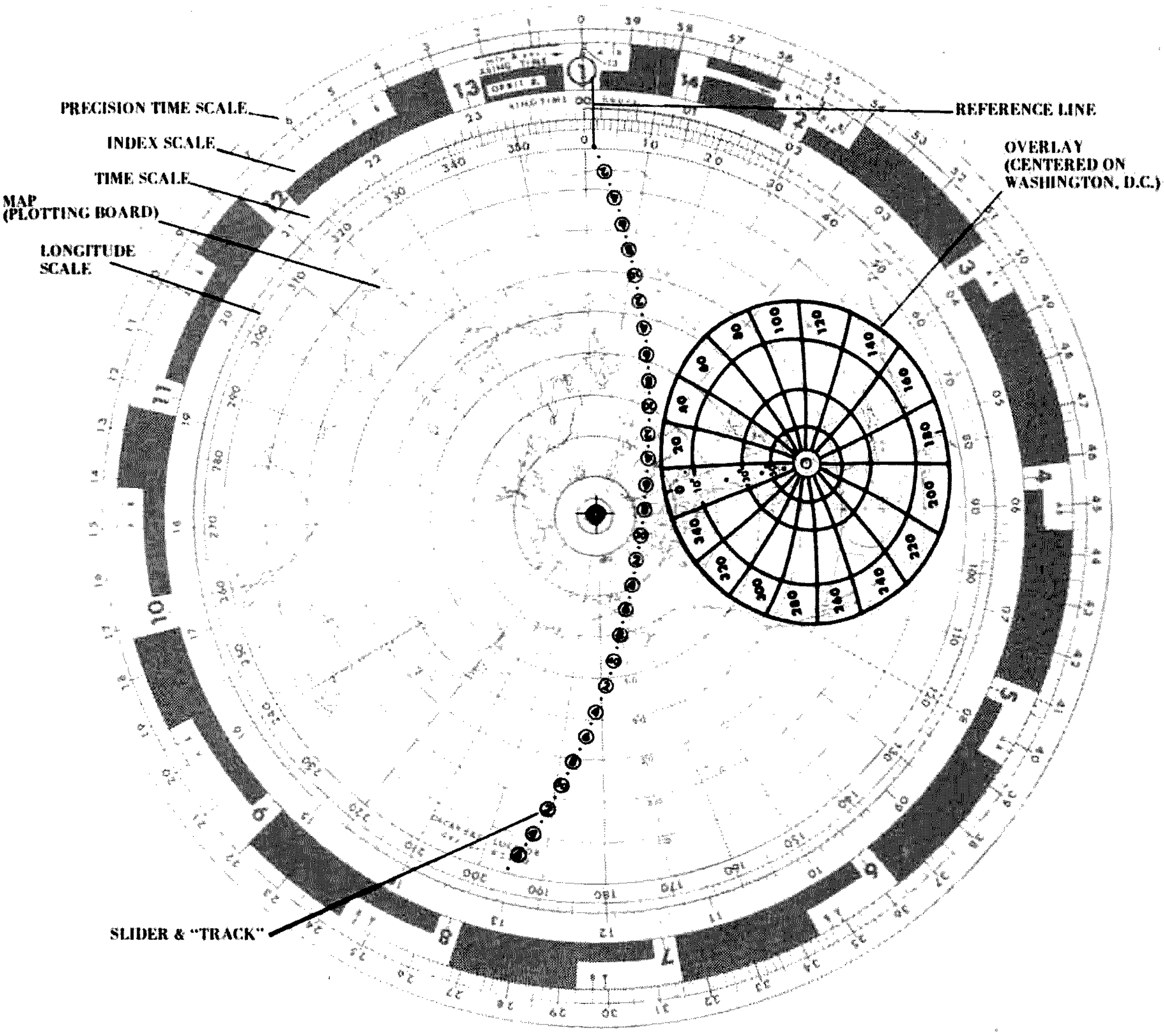


Fig. 1. Total view of Satellabe, showing four concentric scales (Map Plotting Board, Time Scale, Index Scale, and Precision Time Scale), with their relation to each other. The Range Overlay is centered on the QTH of the tracking station. Rotary transparent Slider shows the path and instantaneous location of Oscar in terms of minutes after equatorial crossing. The Slider pivots in the center of the device.

A number of amateurs, lacking adequate tracking facilities, resort to "dead reckoning" – namely, trying to guess the approximate direction and periods of accessibility of Oscar satellites. On the other end of the scale, there are individuals who by employing sophisticated mathematical formulas, processed by modern computers, come up with tracking data which equal those used by NASA.

In the middle, there is a group of Oscar users which has developed all kinds of "private" tracking methods, using globes, maps of different projection, and other ingenious schemes or devices perfectly suitable for their intended purpose. Unfortunately, the remainder of amateurs who own suitable equipment for space communications become so overwhelmed by the apparent complexity of satellite tracking that, in all probability, they never even attempt to try this new and exciting form of amateur communications.

The device described in this article allows tracking of Oscar satellites with an accuracy exceeding the needs of even the discriminating amateur. It requires no knowledge of the mathematics or astrophysics on the part of the user.

It resembles a circular slide rule 11 inches in diameter with a map of the northern hemisphere in the middle. It operates on the principle of an "astrolabe," an instrument used by astronomers in the ancient times for predicting the apparent movement of celestial bodies as viewed from a particular location on the earth. I feel that this

"instrument" can be called a Satellabe for lack of a better name.

The Satellabe must be pre-set only once a day using EQX data of the reference orbit of the day for which it will be employed. Once pre-set, the following become immediately available in easy and illustrative form:

– EQX time and longitudes of all consecutive orbits of that day with an accuracy of ±5 sec time and ±.5° longitude.

– Location of sub-satellite point in respect to the northern hemisphere at any time during the next 24 hours with an error no larger than 100 miles.

– Periods of time, ±.5 minute, during which the satellite remains within theoretical range of accessibility of the tracking station.

– Instantaneous beam headings, both azimuth and elevation, during each in-range pass of the satellite. The accuracy is about ±5° for distant passes, but it is somewhat worse for close approaches where the elevation changes very rapidly with time.

– EQX data of the reference orbit of the next day, accurate to within ± 2 sec time and ±.5° longitude.

The Satellabe is an analog device and, like a slide rule, its accuracy depends on the precision with which it is made. Conceivably, this device can be made much more accurate if techniques employed in developing good quality circular slide rules are used.

The Satellabe (Fig. 1) resembles a circular

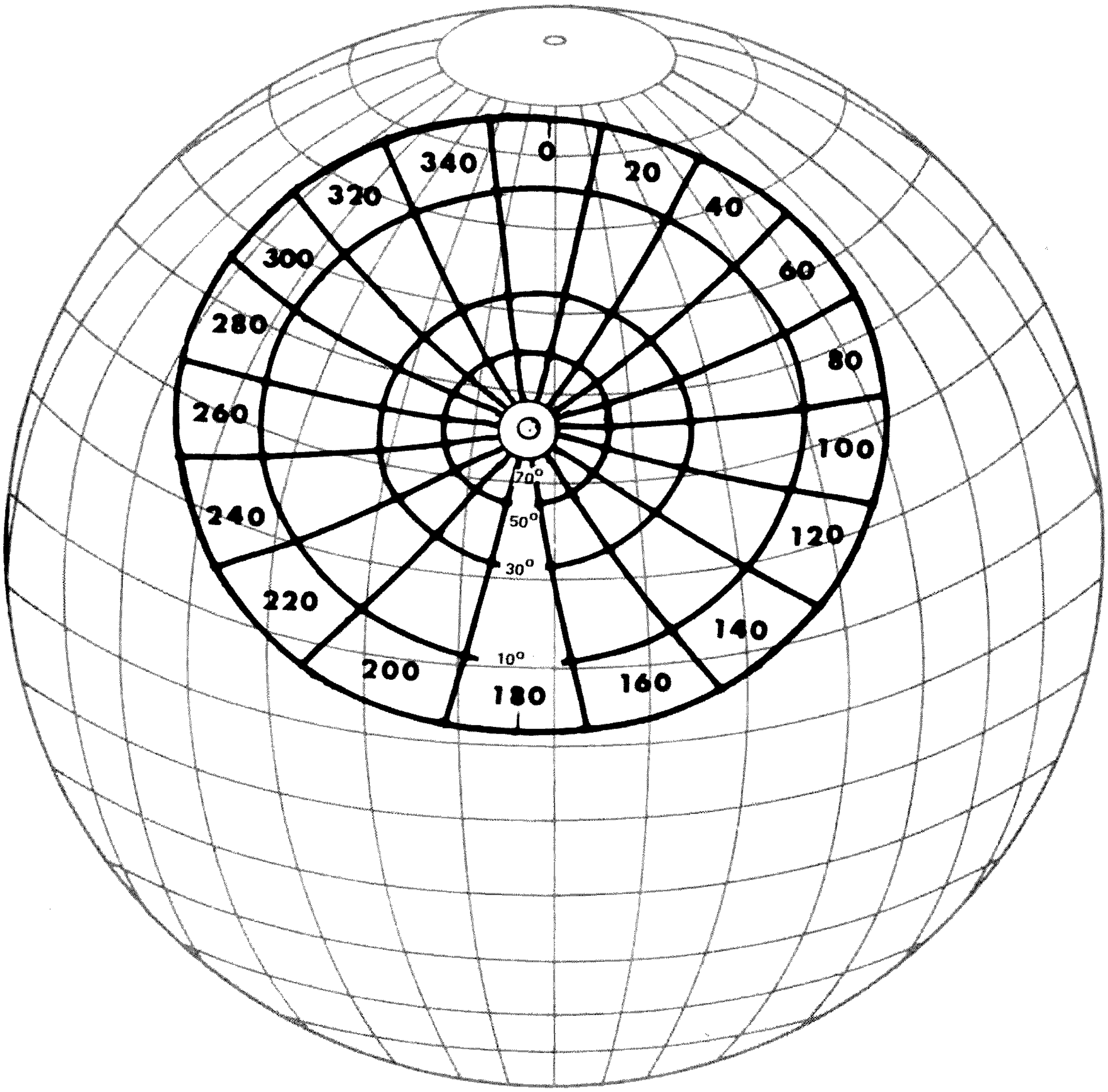


Fig. 2. Range Overlay placed on a globe. The circle represents the area of accessibility of Oscar (2450 miles) from the point in the center of the Overlay. Azimuth lines shown are 20° apart. Concentric circles show the locations where the satellite will be positioned 10°, 30°, 50° and 70° above the horizon of the tracking station; interpolation is used for in-between angles.

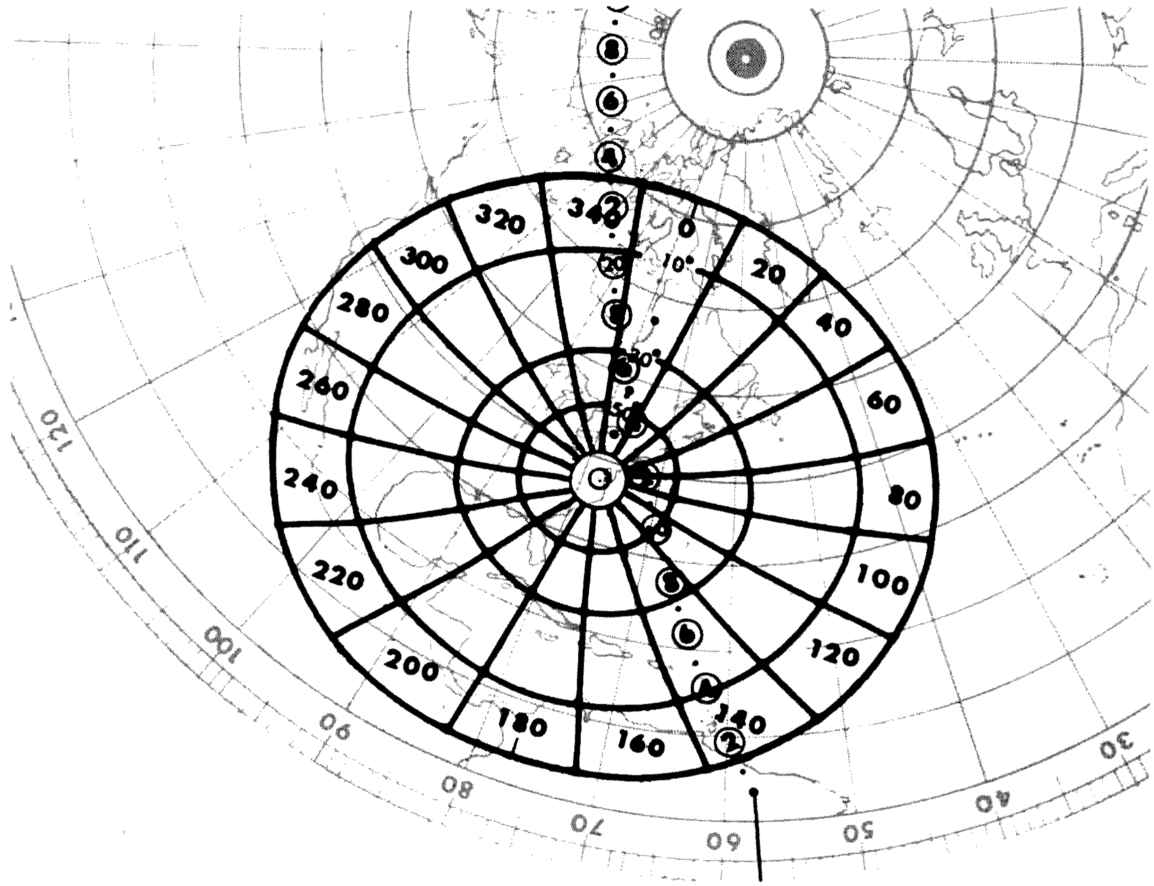


Fig. 3 (Section of Fig. 4). The Range Overlay transposed on a flat map looks like an ellipse; straight azimuth lines become curved. The position of the satellite in respect to the tracking station is determined by its instantaneous location, in terms of minutes after crossing the equator, and by relating it to markings on the Overlay. It can be seen, in this example, that during this pass Oscar will enter the area of accessibility 2.5 minutes after EQX and descend beyond the horizon 24 minutes after EQX. 12 minutes after EQX, for instance, the azimuth will be 100° and elevation 50° in relation to the tracking station.

slide rule. It has 4 scales, one of them representing the map of the northern hemishere,, and a rotating slider that simulates the "track" of the satellite. In addition, a Range Overlay is provided. This overlay is affixed on the map and must be centered on the user's QTH. All scales and the slider pivot on the center (north pole) of the map.

DESCRIPTION AND FUNCTIONS OF SCALES

The Plotting Board (Map)

The first (innermost) scale depicts a polar projection map of the northern hemisphere with degrees of longitude indicated on its circumference. The map serves as a Plotting Board where the position of the satellite is being determined. A polar graph can be used instead of the map; the map, however, is more illustrative.

The Slider and "Track"

The Slider, made of thin transparent material, represents the "track" (locus of sub-satellite points) of any spacecraft orbiting the earth with a period close to 115 minutes and inclined approximately 102°; Oscar 6 and 7 and several weather satellites belong to this category. The "track" is so designed that when its Reference Line is set on the longitude of a chosen EQX, the "track" follows the path of the satellite during this particular pass. The numbers printed along the track indicate the location of the satellite after that many minutes from the moment the space craft crossed the equator.

Using the map with the described slider and knowing all daily EQX data is sufficient to plot the location of the satellite at any time during that day. Those informations,

however, are not adequate to determine the exact position of the satellite with respect to the geographical location of the tracking station. At this stage, we can only roughly estimate the approximate direction, elevation, and periods of accessibility by "dead reckoning" and educated guesses.

The Overlay

In order to obtain more accurate information regarding azimuth, elevation, and the time when the satellite passes over the horizon, as viewed from the QTH of the tracking station, a range overlay has been developed.

If such an overlay was designed for a globe (rather than a flat map) it would take the form of a circle with a radius equivalent to 2450 miles, or 35.6 great circle degrees. The overlay must be centered on the geographical location of the tracking station (see Fig. 2). This circle represents the area of accessibility of a satellite orbiting at an altitude of 912 miles. In other words, when the satellite passes through the area of the overlay its position lies above the horizon of the tracking station (not considering local topography) and communication becomes possible. A circle on the globe can easily be divided into azimuth sectors; then, circles of equal elevation angles can be calculated and drawn as shown on Fig. 2.

Due to projection distortion, what is a circle on a globe resembles an ellipse when transferred to a polar projection map; also, straight azimuth lines become curved. With the aid of the overlay, centered on our QTH, we now can easily track the satellite in reference to our geographical location. While following the satellite minute by minute after it has crossed the equator, we may now determine its azimuth and elevation by relating its instantaneous location to the elevation and azimuth marking of the overlay.

The time of accessibility is simply established by noting the time at which the satellite track enters and exits the overlay (see Fig. 3).

HINT: It is very convenient to use an auxiliary clock. If this clock is set to indicate 00 minutes at the exact time the satellite crosses the equator, the numbers on the

slider will directly correspond to the time shown by the clock.

The Time Scale

The second disc is the equatorial crossing Time Scale. Its function will be described further in the text. This scale is divided into 24 major segments of 15°, representing GMT hours. These are further sub-divided into 10 and 5 minute intervals of 2.5° and 1.25° respectively. You may note, for future reference, that 1 minute on this scale equals .25°.

The Index Scale

The third disc is the Index Scale. It works in conjunction with the first, second and (not yet described) fourth scale. This scale contains 14 index marks spaced 28.74° apart. They represent the averaged and rounded intervals between successive EQX longitudes of Oscar 6 and 7. (The exact precesses are 28.748637° for Oscar 6 and 28.73625° for Oscar 7.)

If the EQX longitude of the reference orbit of the day is lined up with the #1 index position, the remaining index marks will indicate positions on the equator of all successive EQX of that day. The longitudes of these crossings can be read on the circumference of the map.

The index marks superimposed on the Time Scale (second disc) divide the time into intervals corresponding to the period of a satellite that has a precess that equals the separation, in degrees, of the index marks. Again, if the EQX time of the reference orbit of the day (as read on the Time Scale) is lined up with #1 index position, the remaining index marks will indicate the time of successive EQX's.

The precess and the period of a satellite are directly related to each other. The fact that the earth revolves 360° in 24 hours, or in 1440 minutes, means that any point on the surface of the earth travels with an angular velocity of .25° per minute. Consequently, during one period of the satellite (P) the earth rotates P/4 degrees. Therefore, the quantity P/4 becomes equal to the precess of the satellite.

The above relation allows using the index marks spaced P/4° apart for indexing both

time and longitude of consecutive EQX's. The index marks of the Satellabe, spaced 28.74° apart, assume the averaged period of Oscar 6 and 7 to be 114.97 minutes or 114 min. 58.2 sec. Since the period of Oscar 6 is 114 min. 59.673 sec. and that of Oscar 7 is 114 min. 56.7 sec, the error amounts to approximately 1.5 seconds per orbit. Such an error is too small to be resolved on the Time Scale. Actually, considering the relatively small size of the Satellabe, the equatorial crossing time, read on the Time Scale, can be determined to an accuracy not much better than ±1 minute, even on the most accurately drawn and centered devices.

Summarizing: It has been shown that setting the EQX time and longitude of a reference orbit under position #1 of the index scale results in immediate availability of EQX data of all successive orbits of the day. Furthermore, placing the reference line of the slider against any of the index marks allows display of the path of the satellite during that particular pass over the northern hemisphere.

This feature is very convenient for the purpose of "pre-viewing" the entire day's operation. Rotating the slider from one index mark to the next, it now becomes very easy to see which passes will be in-range,

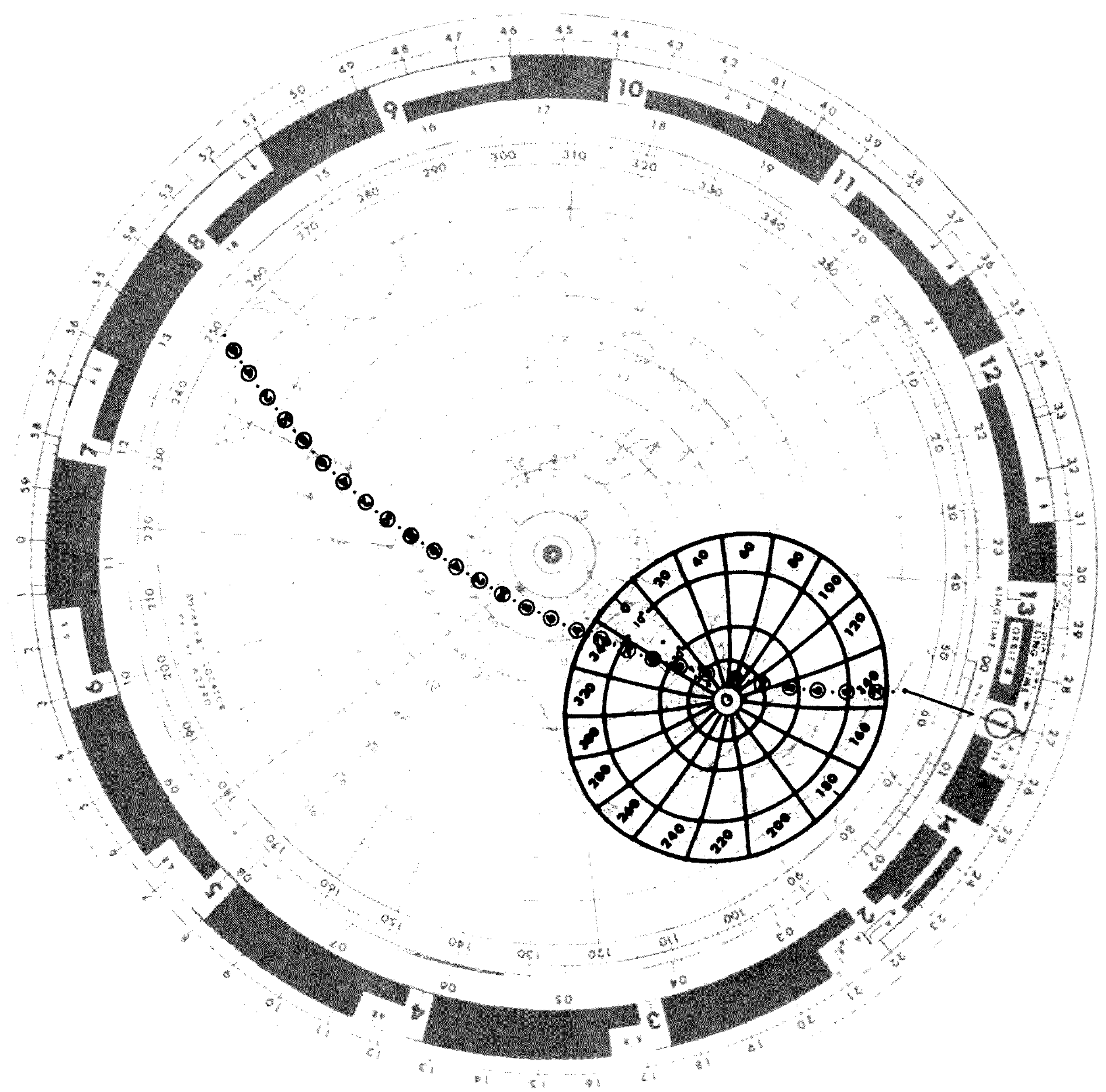


Fig. 4. Setting of the Satellabe for operation on February 24, 1975. The EQX time and longitude of the Reference Orbit are 00:26:54 GMT and 56.6°. The "track" shows the position of the satellite every minute after the spacecraft has crossed the equator.

marginal, or "out of sight." The times of operation will also be easy to pre-plan because the time when the satellite's path enters the overlay can now be clearly estimated. This is particularly convenient for daytime passes, when the satellite appears within range about one half hour after EQX time.

The Precision Time Scale

Estimating the time of successive EQX's with an accuracy of a couple minutes may be quite satisfactory to most Oscar users. Some amateurs, however, would like to have this data available with much better precision. For those who use very high gain antennas, characterized by very narrow beamwidths, an error of two minutes is significant, especially when the satellite passes nearly overhead and its elevation changes rapidly with time. The EQX time inaccuracy of the Satellabe can easily be corrected if orbital predictions of all daily passes are available. Those who have access only to reference orbit data must resort to the pencil-and-paper method.

In order to improve the accuracy of prediction of successive EQX time, the Precision Time Scale has been developed. This scale, the fourth, is divided into 60 sections of 6° each, representing minutes, and is further sub-divided into 10 second segments at 1° intervals.

An additional set of index marks, designated "A" for Oscar 6 and "B" for Oscar 7, has been placed on the outer rim of the index scale and "framed" together with the corresponding original index marks described previously. "A" and "B" index marks will be used to predict EQX time with an error of only a few seconds. This accuracy can be tolerated by even the demanding Oscar users.

In order to predict the time of subsequent EQX's, the rule of thumb in Oscar work is to add 115 minutes, or more conveniently add 2 hours and subtract 5 minutes, to each successive EQX time. Because the exact period of Oscar 6 is 114 minutes 59.673 sec. and of Oscar 7, 114 minutes 56.7 seconds, the "rule of thumb" results in an error of about .3 sec. and 3.3 sec. per orbit for Oscar 6 and 7 respectively. This error may appear trivial; nevertheless, it amounts to more than 40 seconds per day for Oscar 7.

Index marks "A" and "B" are so arranged around the Index Scale as to subtract 5 minutes .3 seconds and 5 minutes 3.3 seconds from the successive EQX time of Oscar 6 and 7. It should also be mentioned that additional marks can be placed for other satellites having different orbital periods.

To use the Precision Time Scale, the minutes and seconds of EQX time of the reference orbit are set against the #1 position of the index scale. Then, the minutes and seconds of all daily equatorial crossings are read *above* marks "A" for Oscar 6 and *above* "B" for Oscar 7 on the Precision Time Scale. The "A" and "B" marks are "framed" together with corresponding precess index marks for easier identification. The hours of EQX time are read on the Time Scale as described previously.

How To Use The Satellabe

Let us try an example:

The tracking point is Washington, D.C., located at latitude 39° N. and longitude 77° W. The overlay is centered on the above coordinates.

The orbital data for February 24, 1975 indicates EQX of the Reference Orbit of Oscar 7 to be 00:26:54 GMT and longitude 56.6°.

The Satellabe is set as shown on Fig. 4.

Lined up under the Reference Line of the Slider are:

EQX longitude 56.6° at the equator of the map;

EQX time 00:27 GMT – Time Scale;

#1 position of Index Scale;

26 min. 54 sec., on the Precision Time Scale (fourth disc).

Analyzing the first pass we see that:

1) Acquisition of Signal (AOS) will occur 2.5 minutes after EQX, beam heading 145°.

2) Beam headings during the pass will be:

MINUTES AFTER EQX	AZIMUTH	ELEVATION
5	142°	10°
7	140	20
9	135	30
10	130	40

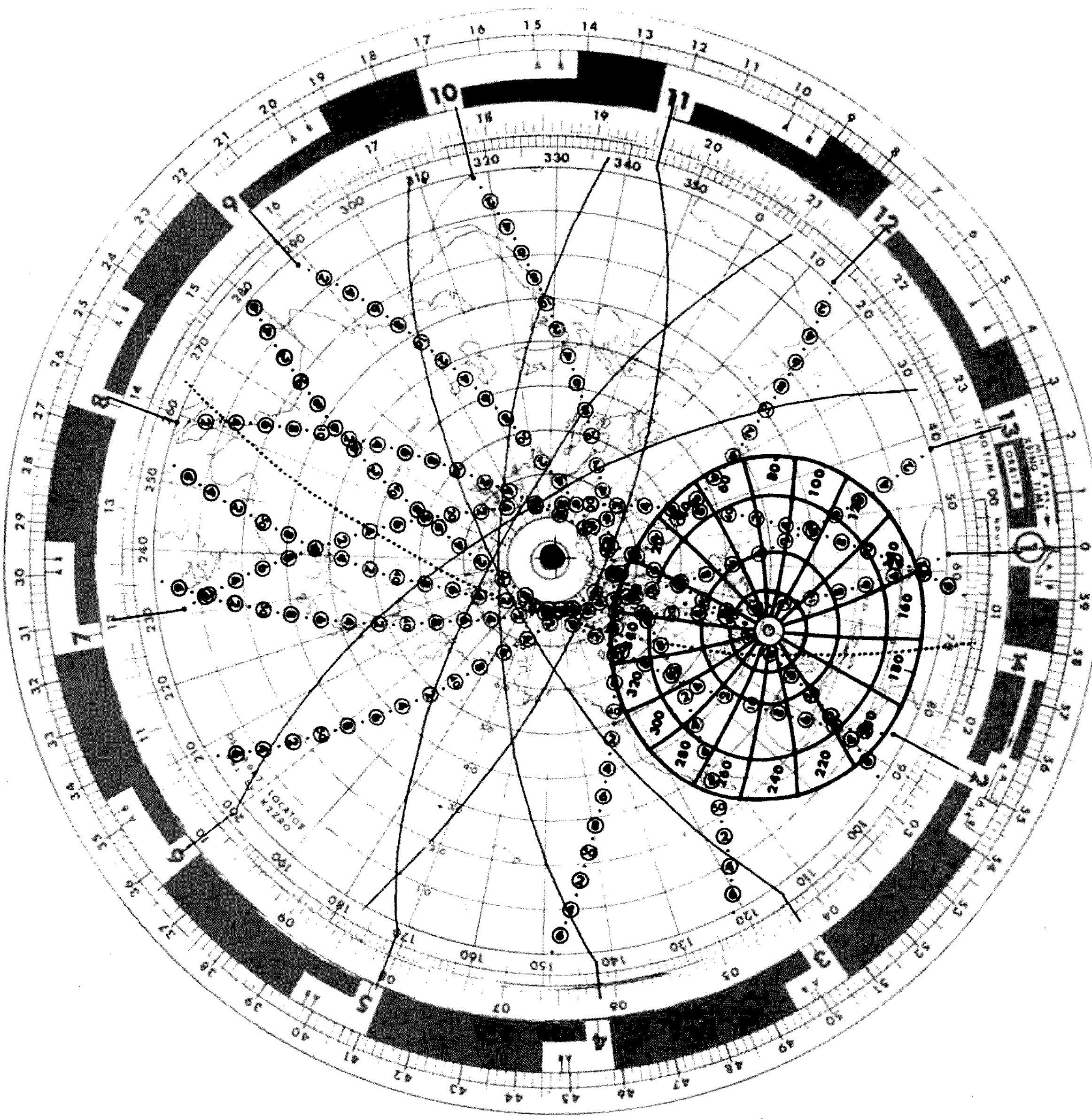


Fig. 5. This drawing may look rather "messy"; nevertheless, it shows all passes of a satellite over the northern hemisphere during one GMT day. Orbits not in-range of the tracking station are shown as solid lines. Moving the Slider through consecutive Index Marks allows recognition of in-range passes and time of AOS and LOS for each orbit. Overhead and marginal passes can easily be recognized. EQX longitude of each pass is read under the corresponding Index Mark; the approximate EQX time is read on the Time Scale opposite Index Marks; the exact time (minutes and seconds) is read on the Precision Time Scale above marks "A" or "B" for Oscar 6 and 7 respectively. The Reference Orbit of the next day is Orbit 14 in this example, because it is the first pass that occurred after 0000 GMT. Setting the values of EQX time and the longitude of the 14th orbit under the Index Mark #1 makes the Satellabe available for the next day's operation. On alternate days pass #13 will be the next day's Reference Orbit.

12	105	50
13	70	60
14	40	60
15	20	50
16	10	40
18	355	30
19	355	20
21.5	350	10
24	350	0

3) Loss of Signal (LOS) will occur 24 minutes after EQX at azimuth of 350°.

Now we will preview the whole day's operation.

Without disturbing the original setting of all scales (locking them with a paperclip works fine) we place the Reference Line of the Slider against each consecutive index mark and draw the following conclusions (see Fig. 5):

Orbit 2

EQX: 02:21:51 GMT; *use marks "B" for Oscar 7;* longitude 85.5°;
Pass within range; AOS-2 min., LOS-22 min. after EQX;
Beam heading 200° -320°;
Closest approach 11 min. after EQX, elevation 30°.

Orbits 3, 4, 5 and 6

Out of range.

Orbit 7

Pass in range; EQX: 11:56:38 GMT; 229°;
Looks like a good pass to work Europe;
AOS-37 min., LOS-55 min. after EQX;
Beam heading 40°-145°; closest approach elev. 20°, 46 min. after EQX.

Orbit 8

Pass within range, almost overhead, close to 90° elevation 45 min. after EQX;
EQX: 13:51:34 GMT; 258°;
AOS-34 min., LOS-56 min. after EQX.

Orbit 9

Pass in range; EQX: 15:14:30 GMT; 287°;
AOS-33 min., LOS-50 min. after EQX;
Closest approach 42 min. after EQX, elevation 20°.

Orbit 10

Marginal pass; EQX: 17:41:28 GMT, 316°;
Probable AOS-34 min., LOS-46 min. after EQX, provided the horizon is virtually at 0° elevation.

Orbit 11

Out of range.

Orbit 12

Pass in range but just about over the horizon;
Good for working Eastern Europe;
EQX: 21:31:20 GMT, 13°;
AOS-16 min., LOS-24 min. after EQX;
Beam heading – horizontal throughout the entire pass, azimuth 60°-10°.

Orbit 13

Pass in range; EQX: 23:26:17 GMT; 41.5° (Note that "A" and "B" marks for Orbit 13 are located to the left of index mark #1 and are labeled "13".);
AOS-55 min., LOS-25 min. after EQX.

SWIPED: Kenwood TS520 transceiver s/n 040600, Drake T4XB transmitter s/n 16869, Drake R4C receiver s/n 18897, Standard SRC826M transceiver s/n 203066, RP MFA22 synthesizer s/n 000133, Heath SB610 monitor scope. $50 reward for information leading to the arrest and conviction of the guilty party(s). Contact Gerald P. Swetsky WB9EBO, 219 E. Division, Villa Park IL 60181 – 833-8122.

LIFTED: Regency HR212 s/n 24-01453 filled with crystals. CFAR – A.F. Mars Repeater 154.34 RX. Contact Clark Fulton W9GYN.

STOLEN: at Dayton Hamfest. Ultracom 25 2 meters FM s/n 090511. Contact Montgomery County Sheriff's office, 333 W. Second St., Dayton, Ohio. John Dykstra VE3BOY.

RUSTLED: 2 meter Gladding 25 from my car March 5. s/n 97050370. Stan Hart WA4GQA.

ROBBED: IC-22A s/n 3401424. Contact Stan Staten K4JOB, 729 No. Edison St., Arlington, Virginia 22203, 703 527-5628 or Officer Dennis of U.S. Park Police – case no. 11527.

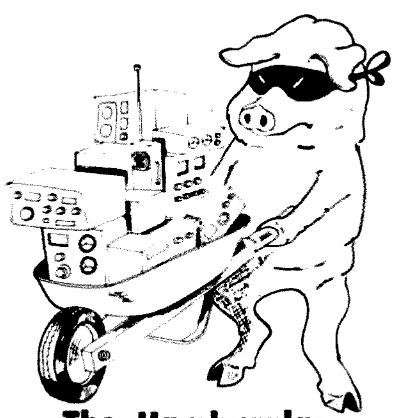
RIPPED OFF: HW-202 s/n 04350; HW-100 s/n 006-4255. Contact Donald L. Upp WB8STQ, 52 East Sherry Drive, Trotwood OH 45426.

TAKEN: Standard 826M w/9 channels installed s/n 106049. Contact Ron WB8NWK9, 1005B W. North Avenue, Villa Park IL 60181.

HIJACKED: Standard SRC-146 ht s/n 3708560 with rubber ducky, external mic, case, 94/94, 34/94, 07/67, 84/24, ABE. Contact Phil WA0QLA, K3TNV or WA6HMC on WR6ABE.

ABDUCTED: Drake TR-22 all channels filled, 131.5 PL circuit 34/94, 94/94, 16/76, 37/97, 52/52, 97/37 s/n 720050 also same number is engraved on chassis near speaker. Contact Allen R. Short WA9FPU, 205 Boardman Drive, La Porte IN 46350.

PILLAGED: Drake TR-22C 2M FM transceiver s/n 810,989. Contained 8 sets of crystals on various repeater frequencies. Also a Johnson C.B., 5 channel set, Model 110. Contact Gerald E. Jelley W8PGC.



The Hamburglar
STRIKES AGAIN!

PLUNDERED: Yaesu FT 401B, serial #316104, Yaesu FV 401, #679927, Collins 75A4, #5564, Johnson Valiant, #29166, Johnson matchbox, Heathkit SB200, electronic keyer, vibroplex key, Yaesu mike, speaker and headphones. Contact Vermont State Police or Peter Kragh, 170 Summit Avenue, Ramsey NJ 07446. W1BRG.

SNATCHED: Varitronics HT-2, serial #640256. Contact Sam Pliscof K3ZPH.

Orbit 14

Pass in range; EQX: 01:21:11 GMT; 70.5°. (Note that "A" and "B" marks for Orbit 14 are located near index mark #2 and are labeled "14".)

Because the EQX of Orbit 14 occurred after 0000 GMT it becomes the Reference Orbit of the next day, namely, February 25, 1975.

Using the data of EQX of this orbit, we set those values (01:21:11 GMT and 70.5° longitude) under index #1 and the calculator is ready for the next day's operation.

The next day's Reference Orbit is either Orbit 13 or 14 of the present day, whichever occurs first after 0000 GMT.

The above example illustrated the simplicity of operation and ease with which the Satellabe can be used for tracking Oscar satellites. All tracking information is presented in a readily understood pictorial form, which makes this device a good teaching tool. The analog operation of the Satellabe, and particularly the ability of pre-viewing the entire day's operation is, I dare say, easier to apply and interpret than computer generated rows of numbers containing essentially identical information.

Familiarity with the Satellabe may yield more information than is presented in the text. Here are a few examples:

1) Using additional overlays centered on different locations of the world would allow one to recognize if that area is workable via Oscar (overlays overlap).

2) All accessible locations can be worked only if the satellite's track passes through the overlapping sector of both overlays. The EQX longitudes and the time of accessibility can be easily predicted ahead of time.

3) The maximum communication range from any location on the northern hemisphere can be established.

4) Using a "movable" overlay, one may track the satellites while mobile and traveling large distances in a short span of time (such as aeronautical and maritime mobile).

5) The satellabe is easily adaptable for tracking satellites other than Oscars which circle the earth in similar orbits.

. . . K2ZRO

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Washington DC 20044

Oscar - A Certificate Hunter's Paradise

Since the first edition of this article appeared in the AMSAT *Newsletter* of June, 1973, operation via amateur satellite has increased approximately threefold. More than 3,000 stations are now active, and the addition of AMSAT-OSCAR 7 with its two translators has introduced a whole new dimension. Several new operating awards have been offered, and the rules for many of the older awards have been changed. The present article has been revised and additional material has been included to bring the awards situation up to date as of February, 1975. As with the previous edition, this article will focus primarily on awards available to amateurs in the United States and Canada, as well as awards of international scope. No attempt has been made to include local or regional-type awards where the areas involved are not within satellite range of North America.

Satellite Communicator's Club

Sponsored by AMSAT, this attractive certificate is offered to any licensed amateur station, anywhere in the world, making a two-way contact through AMSAT-OSCAR 6 or AMSAT-OSCAR 7. To receive yours, send a QSO report, requesting the Satellite Communicator's Club certificate, to AMSAT, P.O. Box 27, Washington DC 20044, USA. Please include the call of the station worked, the satellite, downlink frequency (e.g., 29 or 145 MHz) and modes (e.g., CW or SSB) used, and whether or not you have received a QSL card. A QSL is not required for this award, but sending in a report is. If possible, please use the official AMSAT "Summary Sheet for Two-Way Satellite Contacts," copies of which are available on request. In addition to your certificate, you may request with your report an AMSAT-OSCAR 7 QSL card, telemetry and/or QSO reporting forms, and a printout of the next month's equatorial crossings for both satellites. All free for the asking, but an SASE is appreciated. Only one Satellite Communicator's Club certificate per station, regardless of satellite or band used. Further QSO reports, of course, are welcome, and will be acknowledged by sending you a month of orbits on request.

Satellite DX Achievement Award ("1000")

Sponsored by the ARRL, the "1000" recognizes two-way communication via AMSAT-OSCAR 6 or AMSAT-OSCAR 7. More than 300 of these beautiful certificates have been awarded. To qualify, a station must accumulate 1000 points as follows: Each contact with a new station counts 10 points, each new country counts 50 points, each new continent counts 250 points. Standard DXCC and WAC definitions apply. For example, the first European contact for a WVE would normally count 310 points — 250 for the new continent, 50 for the new country, and 10 for the new station. A station having worked (and confirmed) 15 different stations (150 points), 3 countries (150 points) and two continents (500 points) would have a total of 800 points and would still need 200 more to qualify. QSL cards are required; they must confirm two-way communication via amateur satellite on or after December 15, 1972, plus usual QSL information. Photocopies of the QSL cards are not acceptable. Contacts via AMSAT-OSCAR 6 and AMSAT-OSCAR 7 are equally acceptable and may be intermixed; again, only one award per station regardless of satellite. When you're about ready to apply for the award, request the appropriate application form from ARRL Headquarters, 225 Main Street, Newington CT 06111, USA. Enclose your required QSL cards with the

completed application. Postage of $1.00 is required if you wish cards to be returned via registered mail. Incidentally, the first "1000" award went to club station LA1K and the second to K2LGJ. K2QBW, W6OAL, W1BIH and several others each have received two awards, recognizing work at more than one station location.

OSCAR Worked All States

When the first edition went to press, this award had yet to be won. That honor initially went to W3TMZ, followed by seventeen others, all of whom received special trophies from AMSAT recognizing their pioneering achievement in working 50 states via AMSAT-OSCAR 6. With the launch of AMSAT-OSCAR 7, this award has been taken over by the League, and made a regular (if highly prestigious and exclusive) part of the amateur awards structure. A specially endorsed Worked All States certificate will now be awarded instead of the former trophy. Regular ARRL rules for Worked All States apply, except that Rule 3, prohibiting contacts made through repeater devices, is replaced by a requirement that all 50 states be contacted through an amateur satellite. Each QSL card must confirm two-way contact via AMSAT-OSCAR 6 or AMSAT-OSCAR 7; contacts made via either satellite are equally acceptable and separate endorsements for each satellite are not available. To apply, secure a copy of the WAS application form (Operating Aide No. 8) from ARRL HQ.

Ten American Districts Award

The Lockheed Amateur Radio Club will issue specially endorsed versions of its Ten American Districts Award to show operation via amateur satellite. To qualify for the special endorsement, all QSL cards submitted must confirm two-way QSO via satellite. The award is available to all licensed amateurs and club stations. All contacts must have been made from the same callsign area, but not necessarily from the same location. QSL cards must be submitted as proof of two-way contact with each of the ten USA amateur radio call districts. KH6 counts as the sixth district, KL7 as the seventh. Each QSL must show a postmark or QSL bureau marking, or must be accompanied by the original envelope in which it was mailed. There is no minimum report, but a signal report is required on the card. Send cards and $1 or appropriate IRCs to award manager Bill Welsh W6DDB, Lockheed Amateur Radio Club, 2814 Empire Avenue, Burbank CA 91504, USA.

WVE Satellite Award

Sponsored by the Northern Alberta Radio Club, this award (Worked Canadian VE Call Areas Via Amateur Satellite) is designed primarily to develop a greater interest in amateur satellite communication. WVE stations must contact any four Canadian call areas (V01, V02, VEØ, 1, 2, 3, 4, 5, 6, 7, 8) via amateur satellite. DX stations, including KH6 and KL7, must contact any two. Only contacts after January 1, 1973, will count. An application will consist of the required QSL cards accompanied by a fee of 25 cents for WVE or one IRC for DX stations. Include sufficient Canadian postage or IRCs if cards are to be returned via registered mail. Send cards and fees to the Chairman, Ray J. Nadeau VE6SF, P.O. Box 52, Barrhead, Alberta, Canada.

Washington Satellite Communicators Award

This award has been established by WA7FVT to encourage QSOs with Washington amateurs via satellite. US and Canadian amateurs must work five stations in the State of Washington, DX stations must work three. Only contacts after March 1, 1974, will count. Separate certificates for AMSAT-OSCAR 6 and AMSAT-OSCAR 7 are available. The required QSL cards should be submitted to WA7FVT together with a fee of $1, which covers registered mail return of the cards and certificate. Please note WA7FVT's new address: Tim Blair, P.O. Box 2262, Tacoma WA 98401.

Hawaiian Satellite Communications Award

Sponsored by KH6IHP (ex-W7EOT), this award promotes two-way communication with Hawaiian amateurs via satellite. The required KH6 contacts vary with your location, as follows: Stations located in WAZ Zone 5, plus W8, VE3, ZL and VK must

have one confirmed QSO; those in Zone 4 (minus W8) or Zones 6, 7 or 25 must have two confirmed contacts; all others must have three. QSOs must be dated January 10, 1974, or later. QSL cards showing two-way satellite contact are required, and should be submitted to KH6IHP with a fee of $1, which covers registered mail return of the cards and award. The address is Stephen M. Carson, 1624 Kaweleka St., Pearl City HA 96782, USA.

CQ DX Award Satellite Endorsement

Sponsored by CQ Magazine, this endorsement is offered to holders of CQ CW and SSB DX Awards for working 50 countries via amateur satellite. All QSL cards must show two-way satellite QSO using the same mode as the original certificate; e.g., if you hold the CQ CW DX Award, all satellite QSOs must be via two-way CW. All contacts must be on or after November 15, 1945, but be advised that any cards submitted showing dates before OSCAR 3's launch (March 9, 1965) are most carefully scrutinized! Rules are, in all other respects, the same as those for the basic CQ DX Awards. Contacts made via any amateur satellite are equally acceptable. Complete rules and applications are available by sending a business size SASE to the CW DX Editor, WA6GLD, P.O. Box 1271, Covina CA 91722, USA. Although several amateurs, including VE2BYG, K1HTV, W2BXA, G3IOR and OH2RK, have worked more than 50 countries via satellite, this award has yet to be won because of the single-mode requirement and also because of the need for the prospective winner to qualify for the basic (HF) award itself. It can be done, but it's tough!

More satellite operating awards will undoubtedly be originated as the need for them develops. For example, no amateur has yet worked all six continents via satellite, although many in certain parts of North America have worked five. The first DXpedition to the right part of eastern Siberia will certainly receive a much-needed warm welcome when they return home. As for me, I am waiting for someone to sponsor an award for confirming 49 states – either that, or move Hawaii closer to New Jersey!

... K2QBW

Gary L. Tater W3HUC
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Where's Oscar?

Knowing when AMSAT-OSCAR 7 is within range of your station is perhaps the hardest part of communicating via satellite, but it isn't really that hard once you have done it a few times. This article makes it even simpler by allowing you to see at a glance when the satellite will be available to you.

It is relatively simple to keep track of the evening orbits. An article that appeared in the February, 1975, issue of 73 Magazine, page 54, discusses how in detail. Briefly, if you live in North America, all that you need to do is to check the "AMSAT News" column in 73 Magazine, or obtain orbital information from AMSAT at Box 27, Washington DC, 20044, for the time that the satellite will cross the equator heading northbound that evening. Remember, these orbits listed are the first orbit of the Greenwich day (reference orbits), which means you must use the next day's date. Depending on how far north you live and how far east or west of you the satellite crosses the equator, you should begin to hear signals from four to ten minutes after the crossing.

You'll notice that only one orbit per day is listed. Thus, it is up to you to determine the remaining orbits by adding 115 minutes and 28.75° west for each orbit. If you perform this addition six times, you'll see that the satellite crosses the equator on the other side of the earth and will be in range of your station as it comes down from the North Pole.

For example, if the first orbit of the Greenwich day occurred at 0005Z, it would cross the equator at 51 degrees west longitude. The equator crossings for this day would be as follows:

Orbit #	Time	Degrees West
1	0005Z	51
2	0200	80
3	0355	108
4	0550	137
5	0745	166
6	0940	195
7	1135	223
8	1330	252
9	1525	280

Stations in eastern North America would find orbits one, two and perhaps three, which are ascending node (northbound) passes, useful for satellite communications. Later in the day, three more orbits would be useful to these same stations – orbits 7, 8 and 9. Since the satellite crosses the equator heading northbound at the equator, the satellite becomes available for North Amer-

GMT	Reference Orbit °W Longitude	GMT	Morning Southbound °W Longitude
0159	79	1428	86
0150	76	1418	83
0140	74	1408	81
0130	72	1358	79
0120	69	1348	76
0110	66	1338	73
0100	64	1328	71
0050	61	1318	68
0040	59	1308	66
0030	57	1258	64
0020	54	1248	61
0010	52	1238	59
0000	50	1228	57
Ascending Node		Descending Node	

Table 1. Translation for OSCAR 6 and OSCAR 7 descending node orbits. Accuracy is ±1°.

ican amateurs as it comes down from the North Pole. Thus, orbits 7, 8 and 9 in this example are called descending node orbits.

It's a simple matter to calculate where the satellite would cross the equator on this side of the world for the seventh orbit:

$$223^\circ + \frac{28.75^\circ}{2} - 180^\circ = 55^\circ$$

In this equation, the 14 degree term represents the degrees the earth turns while the satellite moves from the equator to the North Pole and back to the equator.

There is no need to calculate each of the orbits and the translation every day, as was done above to determine the descending node passes. Table 1 is a handy look-up chart that provides a translation from the northbound reference orbit to southbound orbits for the next morning. The table is particularly handy for the eastern United States. If you live in the far west, you might want to extrapolate the table to run from 0200 GMT to 0400 GMT.

To use the table, you need simply to determine the reference orbit for the appropriate Greenwich day. Then use the corresponding time in the southbound column that the satellite will cross the equator traveling southbound. About 20 to 25 minutes earlier you should acquire signals. If this pass is overhead or east of you, another pass that should be available to you can be found by adding 115 minutes and 28.75°W to the one you just looked up, just as you did to the reference orbit for the evening passes.

From the above example, the first useful descending node pass from the table for the day with a reference orbit of 0005Z would be 1233Z at 58°W. Another pass would occur at 1428Z at 87°W. It's as simple as that!

... W3HUC

K. O. Learner II K9PVW
RR 5 Box 307
Kokomo IN 46901
and
W. A. Kotras K9HUI
2809 Westbrook Ct.
Kokomo IN 46901

Oscar RTTY Converter

There are many fine RTTY terminal units, such as the ST-6, that can be used to copy the RTTY teletype telemetry from AMSAT-OSCAR 7. However, if you do not plan to work RTTY but are interested in receiving RTTY from the satellite, then the simple terminal unit presented here may be what you need.

Space-Only Keying

To conserve power on AMSAT-OSCAR 7, the RTTY is transmitted as space-only keying. Although the space-only transmission technique of the system may seem unusual, it has the advantage of reduced power consumption compared to the 100% power duty cycle of conventional RTTY. Fixed station applications of RTTY can tolerate high power consumption, but in a space satellite the power available from the solar arrays is at a premium. In addition, the space-only keying allows a much simpler terminal unit to be used to convert the audio signal into the pulses required by the printer.

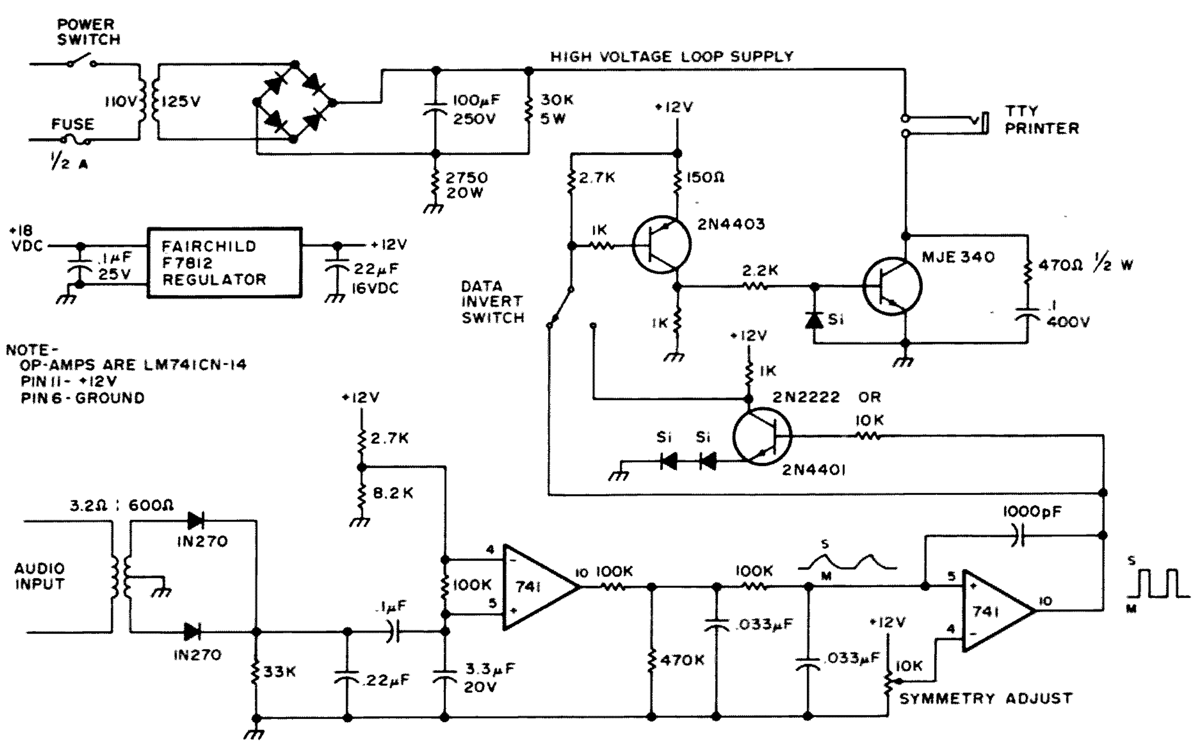

Fig. 1.

The Circuit

The usual TU consists of circuitry to discriminate between the mark (2125 Hz) and space (2975 Hz) tones received. Since only one tone (space) is received, it is necessary only to determine if the tone is present or absent. A simple envelope detector may be used for this purpose.

Since only a single frequency is being received, the station receiver may be operated in the CW or narrow filter mode, thus increasing the signal-to-noise ratio by significantly reducing the bandwidth. Any receiver with a 400 Hz bandwidth CW filter can be used. The receiver should be tuned for an audio output of 1 kHz.

The 1 kHz audio output of the receiver with good S/N ratio is then converted to a varying dc voltage by an envelope detector. This signal is then amplified by a 741 op-amp stage and drives an additional filter having a high level output for the space condition and a low level output for the mark condition. The slow rise and fall times of the varying voltage are converted to the on/off keying signals by means of a 741 op-amp used as a comparator. This stage then drives a two stage driver and a high voltage loop keying circuit of conventional design.

Only one adjustment is necessary for proper operation. This is the "symmetry pot", which establishes the switching point of the comparator. The ideal alignment method is to adjust this pot for a symmetrical mark and space element time of 22 ms. A space-only signal source can be obtained by tape recording the AMSAT-OSCAR 7 RTTY transmissions. In lieu of a calibrated scope, the "symmetry pot" may be adjusted for best printing.

Results

AMSAT-OSCAR 7 is currently being operated in the Teletype telemetry mode when the spacecraft is in Mode B. This means that the RTTY space-only 145.972 MHz beacon is available to amateurs on alternate (even) UTC* days of the year. This configuration is ground commandable and may vary with other developments of spacecraft hardware.

Results with this simplified TU have been quite good. Many AMSAT-OSCAR 7 passes have been printed, and punched paper tape has been prepared for computer processing for AMSAT by W3HCF. Of course, receiver tuning is somewhat critical, since the approximately 6 kHz of Doppler shift is several times the 400 Hz bandwidth of the receiver. The envelope detector is less frequency dependent than the CW filter of the receiver. If the receiver audio tone is audible, the print quality will be good.

The telemetry data returned by AMSAT-OSCAR 7 is both interesting and educational and is easily obtained using this TU configuration.

REFERENCES

Hoff, W6FFC, "The Mainline ST-5 RTTY Demodulator", Ham Radio, September, 1970, p. 11.
Hoff, W6FFC, "The Mainline ST-6 RTTY Demodulator", Ham Radio, January, 1971, p. 6.
Webb, W4FQM, "Phase-Locked Loop RTTY Terminal Unit", Ham Radio, January, 1972, p. 8.

... K9PVW, K9HUI

*UTC – Coordinated Universal Time.

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How You Can Take Oscar's Temperature

Have you ever wondered what the temperature inside AMSAT-OSCAR 7 is? As the satellite has been in orbit since November 15, 1974, perhaps you want to know how the batteries are holding up. The answers to these and many other facts about the status of OSCAR 7 are readily available to you from the CW signals transmitted by the beacon transmitters on the satellite. Best of all is the fact that all you need to get started is a ten meter receiver and the ability to copy numbers in CW!

What Is Available

There are twenty-four parameters transmitted by the Morse code telemetry system on board OSCAR 7. Table 1 lists these channels and the parameter each channel is measuring. As you can see, the first five channels indicate the current in milliamperes from the solar cells that generate the power for all of the systems on OSCAR 7. Channel 2B monitors the power output of the transmitter for the 70 centimeter to 2 meter transponder. The next channel, 2C, increases by one count every 14.4 minutes and is used to show that the spacecraft twenty-four hour clock will switch the satellite between the two transponders at 0000Z. Channels 2D through 3C can tell you the status of the batteries. Temperatures at strategic places in OSCAR 7 are monitored by channels 3D through 5A and 5D. The remaining channels

CHANNEL	PARAMETER	EQUATION
1A	Total Solar Array cur (mA)	$I_T = 29.5N$
1B	+X Quadrant cur (mA)	$I_{+X} = 1970\text{-}20N$
1C	-X Quadrant cur (mA)	$I_{-X} = 1970\text{-}20N$
1D	+Y Quadrant cur (mA)	$I_{+Y} = 1970\text{-}20N$
2A	-Y Quadrant cur (mA)	$I_{-Y} = 1970\text{-}20N$
2B	70/2 Pwr Out (W)	$P_{70/2} = 8\ (1\text{-}.01N)^2$
2C	24 Hr Clock Time (hrs)	$t = .253N$
2D	Bat. Charge-Discharge cur (mA)	$I_B = 40\ (N\text{-}50)$
3A	Bat. Voltage (volts)	$V_{BAT} = .1N+6.4$
3B	½ Bat. Voltage (volts)	$V_{½B} = .1N$
3C	Bat. Charge Reg #1 (volts)	$V_{CRI} = .15N$
3D	Bat. Temp (°C)	$T_{BAT} = 95.8\text{-}1.48N$
4A	Base Plate Temp (°C)	$T_{BP} = 95.8\text{-}1.48N$
4B	PA Temp 2/10 Transponder (°C)	$T_{10M} = 95.8\text{-}1.48N$
4C	+X Facet Temp (°C)	$T_{+X} = 95.8\text{-}1.48N$
4D	+Z Facet Temp (°C)	$T_{+Z} = 95.8\text{-}1.48N$
5A	PA Temp 70/2 Transponder (°C)	$T_{2M} = 95.8\text{-}1.48N$
5B	PA Emitter Cur 2/10 (mA)	$I_{10M} = 11.67N$
5C	70/2 Transponder Modulator Temp (°C)	$T_{MOD} = 95.8\text{-}1.48N$
5D	Instrument Switching Regulator Cur (mA)	$I_{ISR} = 11+.82N$
6A	Rf Pwr Out 2/10 Transponder (mW)	$P_{2/10} = N^2/1.56$
6B	Rf Pwr Out 435 Beacon (mW)	$P_{435} = .1N^2+35$
6C	Rf Pwr Out 2304 Beacon (mW)	$P_{2304} = .041N^2$
6D	Midrange TLM Calibration (volts)	$V_{CAL} = .01N$

Table 1. Morse code telemetry channels.

measure emitter currents of power amplifier stages and power outputs of several of the transmitters on board. An analysis of each of these channels is available in an article listed in the references.

Frequency

The Morse code telemetry system is available to you on 29.500 MHz. The ten meter downlink for OSCAR 7 covers the frequencies from 29.40 to 29.50 MHz with SSB activity below 29.445 MHz and CW activity above 29.455 MHz. Amateurs in the CW segment usually leave a five kilohertz guardband below the beacon, so you should have no trouble finding it.

The 29.50 MHz beacon is always on when the two to ten transponder is on (Mode A). This occurs on odd days (GMT) of the year. On the even days of the year the seventy centimeter to two meter transponder (Mode B) is on and the 29.50 MHz beacon is off.

How It Is Done

The first thing you need to do is to determine when the satellite will be within range of your station. The references list several articles that explain when to listen. When you begin to hear stations in the ten meter downlink, tune your receiver to 29.50 MHz and look for a carrier that transmits only numbers.

After copying the numbers for a few minutes, you will see the following pattern emerging:

1xx 1xx 1xx 1xx 2xx 2xx 2xx 2xx 3xx 3xx 3xx 3xx etc.

Table 2 lists the six lines of Morse code telemetry in a convenient format in case you miss some digits due to fading or QRM. The first digit and its placement indicates the channel number (1A, 1B, 1C, etc.) and the two remaining digits provide the information we are looking for.

Data Conversion

Hopefully, by the time the satellite is out of range you will have copied data on each channel several times. Take the last two digits of each channel and substitute this value for N in the equations in Table 1. For example, let's assume channel 3D read 51.

	A	B	C	D
1	1xx	1xx	1xx	1xx
2	2xx	2xx	2xx	2xx
3	3xx	3xx	3xx	3xx
4	4xx	4xx	4xx	4xx
5	5xx	5xx	5xx	5xx
6	6xx	6xx	6xx	6xx

Table 2. The six lines of OSCAR 7 CW telemetry.

The equation for 3D battery temperature is:

$$T_{bat} = 95.8 - 1.48\,N\ (^\circ C)$$
$$T_{bat} = 95.8 - 1.48\,(51)$$
$$T_{bat} = 95.8 - 75.48$$
$$T_{bat} = 20.32^\circ C$$

As you can see, for this example the temperature of the battery is essentially room temperature, which is quite often the case. If you copy this telemetry for several passes, you will see that some channels remain relatively constant while others vary considerably.

Helpful Hints

Should fading occur while you are copying the beacon, there are several landmarks that you can use to identify what channel is coming up next. After channel 6D, the telemetry system sends "HI HI" and starts the entire cycle again. If you copy a channel that reads 200 and the satellite is in mode A, then it's most likely you have just received channel 2B, as this is the value transmitted when the 70/2 meter transponder is not in use.

Because telemetry reports are used by AMSAT to chart trends in the satellite's life, you should submit the data you collect along with such pertinent information as orbit number, date, time, signal strength and your receiving equipment to AMSAT, Box 27, Washington DC 20044. If you enclose an SASE you will receive two months of orbital data.

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Kasser and King, "OSCAR 7 and its Capabilities", QST, February, 1974, p. 56.
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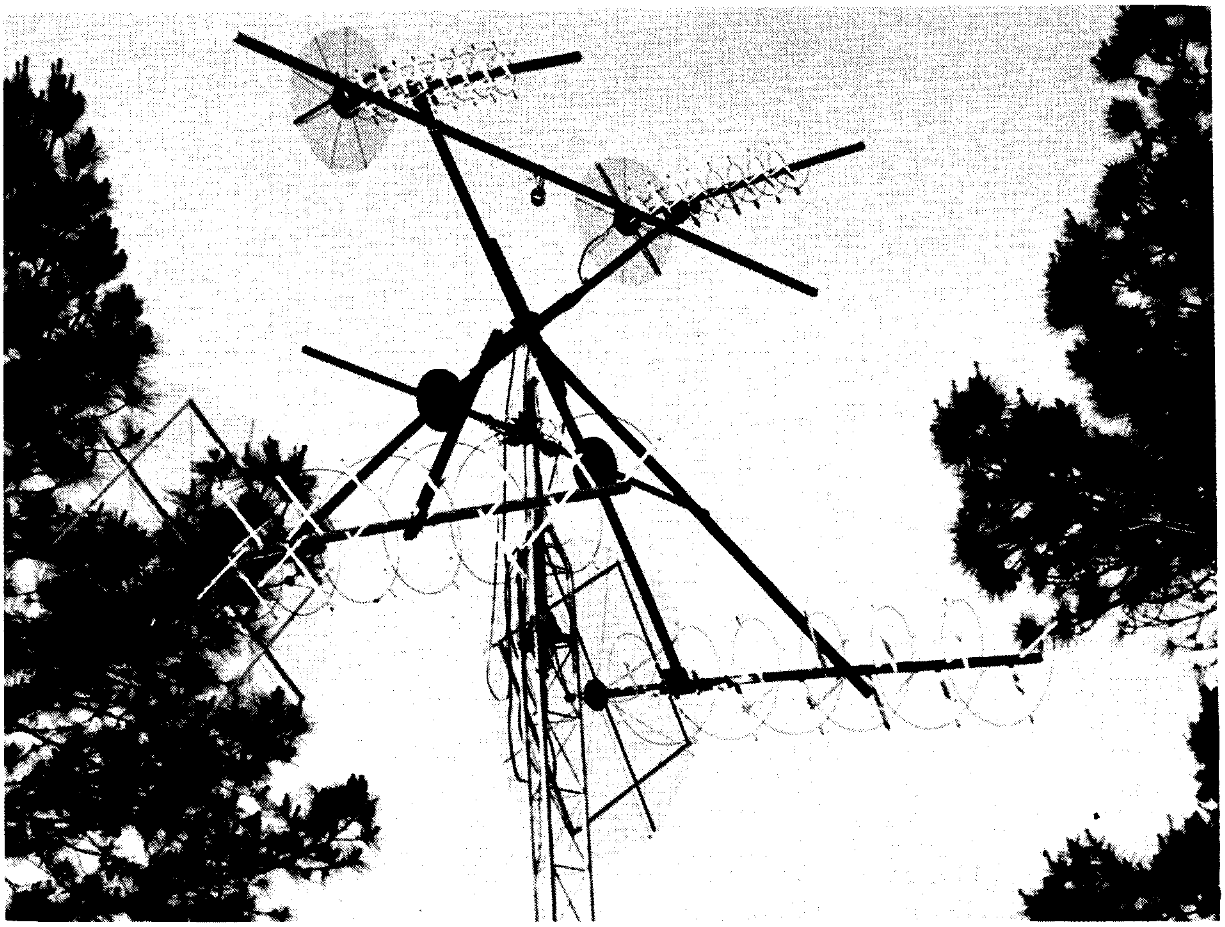
Really Zap Oscar with this Helical

Part One

The helical antenna has been around since the 1940's or earlier – it was invented by Dr. John D. Kraus, who has written many papers on helical antennas and their properties [1]. The helical beam antenna or the axial mode helix has several unusual characteristics which make it desirable for use in amateur satellite and space communications. This antenna operates as an end-fire or beam antenna and generates circularly polarized radiation. This type of radiation persists over a 2-to-1 range in frequency, while the gain is nearly maximum over this range. The gain and the beam width, as well as other characteristics of the axial mode helix, depend upon the number of turns; the more turns, the higher the gain and consequently the narrower the beam width. The axial mode helix can be used in designing a versatile, high performance antenna system since one can achieve right circular, left circular, and linear polarizations with helices. With satellite communications becoming an important facet of amateur radio (especially with OSCAR 7), an array of helices for both 2 meters and 70 centimeters with moderate gain was built during the spring and summer of 1974. The antenna array, which is shown in the photos, consists of four antennas in total, with a pair of helical beam antennas, of opposite sense, for both 2 meters and 70 centimeters, so that right circular, left circular, and linear polarizations can be selected.

If beam antennas are used with amateur radio communications satellites, such as the OSCARs, then one must be able to "track" or follow the satellite by using azimuth-elevation rotators. A narrow beamwidth or high gain antenna makes the tracking more difficult, as a narrower beamwidth requires greater pointing and tracking accuracy; when designing moderate to high gain narrow beamwidth antennas, this point must be kept in mind. It was my belief that the number of turns for a helical beam antenna for use with the OSCAR 6 & 7 satellites should be between 6 and 8 turns. Thus a desirable gain and half-power beamwidth are of the order of 10 to 15 dBi and 45 to 50 degrees, respectively. With the assistance of Cliff Burdette WA8GRE, I have made antenna pattern measurements that indicated a half-power beamwidth of 39 degrees and a gain of 16 dB over a half wave dipole for an 8 turn helix designed for 70 cm and tested at 445 MHz. A helix of more than 8 turns represents a gain too high to be used for amateur satellite communications (i e., the beamwidth would be too narrow), unless



The antenna array completed and installed on the tower. The 70 cm helices are at the top, with the 2 m helices at the bottom. Each pair of helices are of opposite sense. The conduit or horizontal boom on which the elevation rotor is mounted is 10 feet long, making the size of the array about 11x11 feet.

very precise, automatic tracking is available.

There are, of course, certain tradeoffs that have to be made in using high gain antennas for OSCAR 6 and 7, as using an omnidirectional, low gain antenna with an effective radiated power of 80 to 100 Watts is recommended and, in fact, does not present the problems associated with successful tracking of satellite passes. But building and experimenting with helical beam antennas has been most enjoyable. This article describes the helical beam antenna, its design parameters and characteristics, the basic design, construction and installation of the helices that I have built, and antenna range measurements and results.

Circular Polarization

A brief discussion of circular polarization and the nomenclature used in describing the polarization and sense of the helices is necessary. Circular polarization is desired for space and satellite communications since periodic fading, due to the Faraday Effect as well as tumbling of the satellite, is encountered in trans-ionospheric propagation. Linear polarization is not desirable because of a periodic rotation of the polarization of the radio wave (known as Faraday rotation) as it passes through the ionosphere. For instance, a horizontally polarized antenna would receive very little energy from a wave that was initially horizontally polarized but that had become vertically polarized after traveling through the ionosphere.

With linear antennas the electric vector of the electromagnetic wave radiated from the antenna is parallel to itself, i.e. on a fixed line at all times, whereas in the case of circular polarization the electric field vector rotates continuously around an axis in the direction of propagation, that is, describes a circle. Fig. 1(a) shows how linear polarization maps out a line on a plane normal to the direction of propagation, while Fig. 1(b)

shows how circular polarization maps out a circle. Detailed discussions of circular polarization can be found in References 2, 4, 5 and 6. Circular polarization can be generated by various methods, the most common being crossed linear antennas and helical antennas. The helical antenna is preferred since it has a wide bandwidth, non-critical dimensions, and high unidirectional gain, whereas crossed yagis, for instance, have narrow bandwidths, critical dimensions and impedance-matching problems. Here we are talking about either right circular polarization (r.c.p.) or left circular polarization (l.c.p.)*; alternately we speak of clockwise or anticlockwise polarization which refers to the direction of rotation of the approaching wave.

The axial mode helix can be "wound" for either r.c.p. or l.c.p., and linear polarization is obtained by feeding a left-hand and a right-hand helix in phase. Thus a versatile system can be built around the basic helical beam antenna.

Axial Mode Helix And Its Characteristics

The helix is a basic geometrical form, and can be described in terms of a conductor wound on an imaginary cylinder. The diameter of the helix and the spacing between each turn determine the performance and the radiation mode of the helix. When the circumference of the helix is of the order of 1 wavelength ($0.75\ \lambda < C\lambda < 1.33\ \lambda$, where $C\lambda$ is the circumference in wave lengths), the helix radiates in the axial or beam mode. This particular mode produces radiation that is maximum along the axis of the helix and that is circularly polarized. A broadside or omnidirectional pattern can be obtained with other dimensions, but since we are mainly interested in the beam mode we will not discuss the other modes [1,2]. The pattern shape, circular polarization, and terminal impedance are relatively stable over a wide frequency range. Basically, the axial mode is generated by using a ground plane or screen reflector mounted behind the helix conductor or driven element and fed by a coaxial line as seen in Fig. 2(a). The dimensions associated with the helix as seen in Figs. 2(a) and 2(b) are:

D = Diameter of the helix
S = Spacing between turns
α = Pitch angle = Arctan $\left(\frac{S}{\pi D}\right)$
L = Length of 1 turn
n = Number of turns
A = Axial length = nS
d = Diameter of conductor
g = Distance of ground plane to first turn
G = Ground plane diameter

If one turn of the helix were unrolled on a flat plane the circumference (πD), the spacing (S), the turn length (L), and the pitch angle α are related by the triangle shown in Fig. 2(b). Since the turn length L equals:

$$\sqrt{(\pi D)^2 + S^2}$$

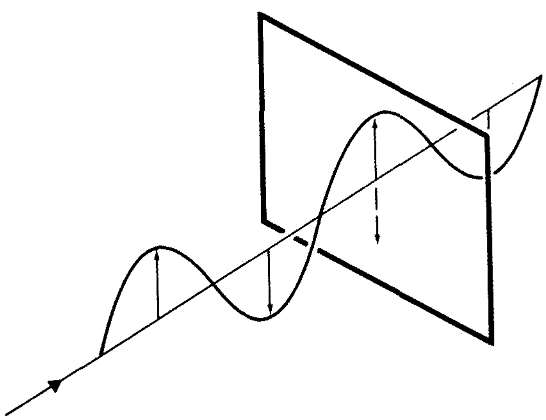


Fig. 1(a). Illustration of waves of linear polarization.

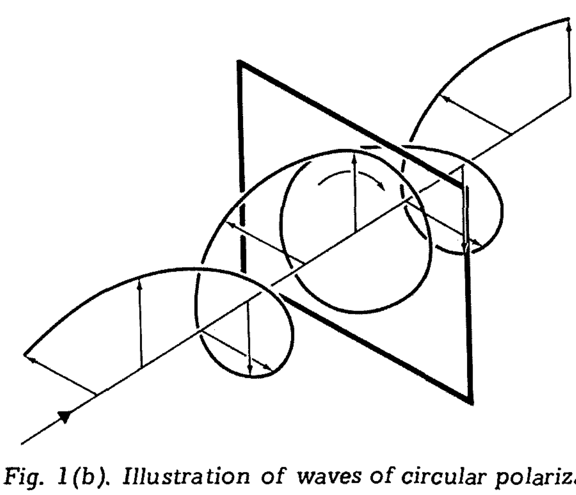


Fig. 1(b). Illustration of waves of circular polarization.

*Recommended polarizations for working OSCAR 7:

MODE	POLARIZATION SENSE Transmitting	Receiving
2m to 10m (A)	l.c.p.	- -
70cm to 2m (B)	r.c.p.	r.c.p.
435.1 MHz beacon	- -	r.c.p.

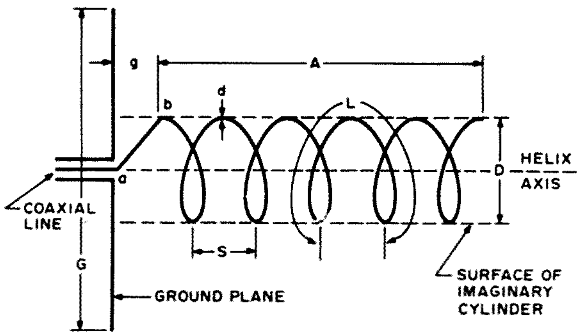


Fig. 2(a). Helix and associated dimensions.

the optimum dimensions for a helix with a turn length of the order of 1.00 λ can be found. The dimensions used in general design of a helical beam antenna, in terms of free-space wavelengths at the design frequency are as follows:

$$D = 0.32$$
$$S = 0.22$$
$$G \geqslant 0.80$$
$$g = \frac{S}{2} = 0.12\,\lambda$$

Other dimensions can be used, but in general the dimensions for the optimum helix are those listed above. These dimensions can be found from the spacing-circumference chart found in Reference 1 and also from the spacing-diameter chart found in Reference 2. The conductor diameter can be from .006 to .05 wave lengths, as the conductor diameter does not seem to critically affect the properties and performance of the axial mode helix when operating in the frequency range of this mode. Various materials can be used for the helix conductor or driven element; here I used a conductor of 3 strands of 12 gauge copperweld wire.

The characteristics of the axial mode helix, such as the gain, half-power beamwidth, axial ratio, and terminal impedance, depend upon the dimensions of the helix and also on the number of turns. In designing a helix the gain and the beamwidth are important parameters, and it is necessary to consider how long the antenna should be, i.e. the number of turns, and what the optimum dimensions should be in order to achieve the desired gain and beamwidth.

When the radiated pattern of a unidirectional antenna is concentrated into a single major lobe, the angular width of the lobe is

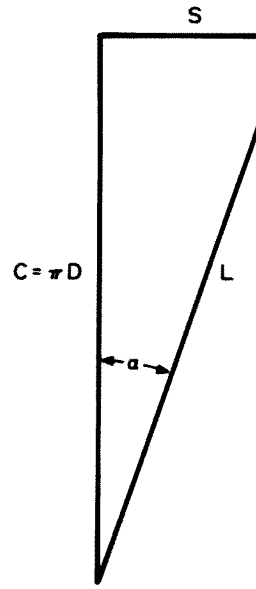


Fig. 2(b). Relation between circumference, spacing, turn length, and pitch angle of a helix.

the beamwidth. The beamwidth is adopted by measuring the beamwidth between the points on the pattern at which the power density is half its maximum value (i.e. 3 dB down). For the helix the beamwidth β between the half-power points is given by:

$$\beta = \frac{52}{C_\lambda \sqrt{nS_\lambda}} \text{ degrees,}$$

where C_λ is the circumference (expressed in terms of free-space wavelengths) and S_λ is

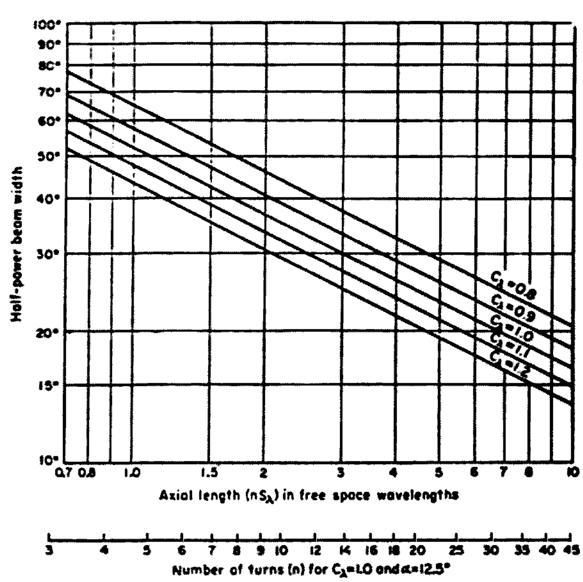


Fig. 3. Half-power beamwidth of axial mode helical antenna as a function of the axial length and circumference in free-space wavelengths and also as a function of the number of turns for C_λ= 1.0 and α = 12.5°. From Antennas, *by John D. Kraus. Copyright 1952. Used with permission of McGraw-Hill Book Company.*

N	Gain for $C_\lambda = 1.00$	Gain for $C_\lambda = 1.05$	Gain for $C_\lambda = 1.10$
3	9.99	10.42	10.82
4	11.25	11.67	12.07
5	12.214	12.64	13.04
6	13.0	13.43	13.83
7	13.675	14.10	14.5
8	14.25	14.68	15.08

Table 1. Gain of Helix as a Function of C_λ and N.

the spacing. This formula applies to helices of turns $n > 3$, $0.75\lambda < C_\lambda < 1.33\lambda$, and $12^\circ < a < 15^\circ$. The half-power beamwidth of the helical beam antenna as a function of the axial length or number of turns is shown graphically in both References 1 and 2. For 6 and 8 turn helices the half-power beamwidth calculated from this formula, with $C_\lambda = 1.00\ \lambda$, is approximately 45° and 39.8° respectively.

The power gain of the helical beam antenna, with respect to an isotropic circularly polarized source, is obtained by dividing the square of the beamwidth into the number of square degrees in a sphere, and is given by

Gain $\approx 15\ C^2_\lambda n S_\lambda$, a power ratio;
or, in terms of a decibel ratio:

Gain $\approx 11.8 + 10\ \mathrm{Log}_{10}(C^2_\lambda n\ S_\lambda)$ dBi.

A graph of the power gain as a function of the number of turns and the circumference of the helix is found in Reference 2. For 6 and 8 turn helices ($C_\lambda = 1.00\lambda$) the gain for $C_\lambda = 1.00\lambda$ is 13.00 and 14.25 dBi, respectively, and for $C_\lambda = 1.05\lambda$ the gain is 13.43 and 14.68 dBi respectively. These formulas do not take into account the effect of minor lobes. Also, the gains quoted in Table 1 and above are with respect to a circularly polarized isotropic source.

The axial ratio is essentially the polarization in the direction of the helix axis and is given by:

$$AR = \frac{2n + 1}{2n}$$

When the axial ratio approaches unity the polarization is nearly circular; for $n > 3$, circular polarization should be obtained.

The terminal impedance is nearly a pure resistance for the helical beam antenna, and for a helix of 3 turns or more with $0.75\lambda < C_\lambda < 1.33\lambda$, the terminal resistance is given by (within ±20%):

$$R = 140\ C_\lambda \text{ Ohms}$$

For a circumference of 1.00 wavelength the terminal resistance is approximately 140 Ohms. This requires impedance matching if one uses 50 Ohm coaxial cable as feedline.

References

[1] John D. Kraus, *"Antennas,"* McGraw-Hill, 1952.
[2] Edward F. Harris, "Helical Antennas," *Antenna Engineering Handbook,* editor Henry Jasik, McGraw-Hill, 1961, Chapter 7.
[3] Doug De Maw W1CER, "The Basic Helical Beam Antenna," *QST,* November, 1965, p. 20+.
[4] T. Bittan G3JVQ/DJ0BQ, "Circular Polarization on 2 Meters," *VHF Communications,* Vol. 5, Edition 2, May 1973, p. 104-109.
[5] Dr. Ing. A. Hock DC0MT, "Theory, Advantages, and Types of Antennas for Circular Polarization at UHF," *VHF Communications,* Vol. 5, Edition 2, May 1973, p. 110-115.
[6] T. Bittan G3JVQ/DJ0BQ, "Antenna Notebook," *VHF Communications,* Vol. 5, Edition 4, November 1973, p. 220.

Next month: Design, construction and installation.

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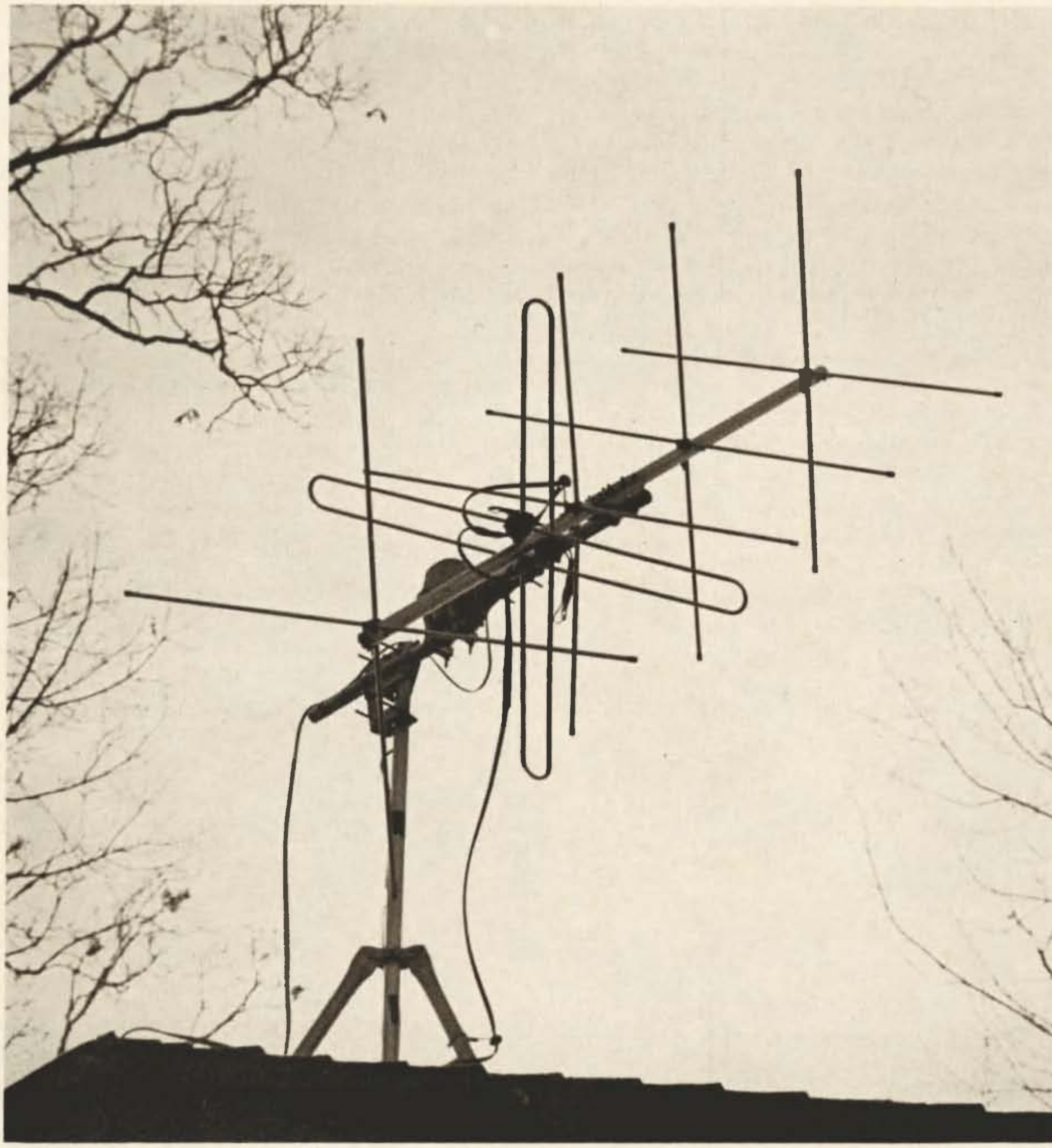
Automating Satellite Reception

One of the many inconvenient aspects of having to work for a living is the action you miss while you're away earning the money to pay for the stuff in the basement. While I'm sure DXers have their own unique perspective on this sad fact of life, satellite enthusiasts also miss out on a lot of fun. Daylight passes of weather satellites, usually in the middle of the morning, represent the only opportunity to acquire visible light cloud cover pictures. Stations interested in acquiring OSCAR telemetry data also miss useful daylight data which are particularly critical in evaluating spacecraft thermoregulation and battery charging status. Having spent a great deal of time and money in building up a weather satellite receiving station, I was rather reluctant to limit myself to acquiring pictures only on the weekends. The automatic station control equipment to be described here was an outgrowth of this frustration.

The heart of the automatic system is the satellite orbital timer previously described in 73 Magazine (February, 1975). Using this timer as a source of time and position data for any satellite you are interested in, it is possible to automatically handle station functions such as turning the receiver and recorder on and off at the proper times, as well as auxiliary functions such as antenna position control. The on-off function is absolutely indispensible; whether or not antenna control is required will depend on the type of antenna available. Since the satellite timer is absolutely required for the operation of the system to be described, the description of the interfacing circuits will take for granted that you are familiar with the function of the basic timer. Actual construction of the automatic circuitry is simple compared to that of the timer, so if you have successfully completed that unit the conversion to automatic station operation will cause little difficulty.

The first step in the evolution of the automatic station control system was the setting of realistic and attainable goals. Given that the project had to be a modest financial undertaking it soon became obvious that some compromises had to be made. The major compromise was to settle for a single satellite pass on any given day. The single pass to be acquired should be the "best" of the day – the one that would yield the greatest amount of data – which in my case meant the most picture coverage. The best daylight pass is an overhead track. The nature of the orbits of both weather and OSCAR satellite orbits is such that if a given satellite normally passes overhead at 9 am local time, the best pass of the day will occur somewhere between 8 and 10 am, with the best opportunity represented by a 9 am pass. This will be obvious if you are already into the satellite game far enough to be thinking about automatic station control. If you are not, I would suggest the satellite tracking article in 73 (January, 1975) as must reading on the subject. If we take our example of an 8-10 am "window" (the actual figures will vary slightly depending upon the satellite, your location, and the season of the year), all that remains is to provide some means of turning the station equipment on and off at the proper time during a satellite orbit. Whether or not antenna controls will also be required will depend on the antenna system used, so we will digress slightly and discuss antenna considerations for the automatic receiving station.



The author's satellite antenna, used with the automatic receiving system. The antenna is a 5 element crossed yagi array with fixed azimuth and variable elevation. The antenna and rotor assembly are mounted on a small tripod. (See Fig. 4.)

Satellite Antennas

The ideal antenna for our system would be an omnidirectional circularly polarized array that would provide solid signals on overhead and near overhead (± one hour) passes. With such an antenna it would only be necessary to turn the receiver and recorder on and off at the proper times and we would be in business. I have yet to develop such an ideal antenna system but experiments by many OSCAR operators may provide a possible solution. A simple dipole, oriented with its ends facing east and west, would seem to be ideal since the satellite would always be in the pattern as it passed overhead. Unfortunately such an antenna always exhibits deep fades even during overhead passes. The problem here is polarization. If the satellite is not fully stabilized it will change polarization in reference to the receiving antenna. Even with a complete stabilization system, the

changing position of the satellite in its orbital track will result in a change in received polarization. If you have had no experience with space communications, it is rather easy to underestimate the effect of a polarization mismatch. The result can be fades of as much as 20 dB, sufficient to take the signal from full quieting one minute to out of the picture the next. Since we are not dealing with a great deal of gain to begin with, it is necessary to bypass the polarization dilemma. One possible solution is the use of a crossed dipole array over a reflecting screen (QST, Sept., 1974). I have not had the opportunity to try such an antenna, but the idea shows promise, particularly if a weatherproofed low noise preamp is installed at the antenna. Experiments along these lines might be justified by stations wishing to keep complexity to a minimum.

It is possible to go to a high gain crossed yagi or helix, but such antennas tend to have narrow beamwidths and hence require rather complex tracking inputs. The solution I adopted was a compromise – a five element crossed yagi (see photo) which has a very broad frontal lobe and hence requires minimal tracking movement to maintain a full-quieting signal. Such an antenna, cut for 137 MHz for weather satellite use or 146 MHz for OSCAR, can be readily constructed using information in the space communications chapter of the ARRL Antenna Book. At my location, an overhead satellite track originates to the NNE and terminates in the SSW. I discovered one morning that if the

Components of the author's automatic satellite receiving station. The digital satellite timer is in the lower right with the antenna control unit to the left and the satellite receiver (Regency TMR-1H converted to multichannel wideband operation) on top of that. The 12 V supply for the station is on top of the satellite timer with the station control and antenna photocell relays stacked on the supply. The antenna relay unit is a separate module simply because of the way I developed my own station, and is most easily enclosed in the antenna control unit.

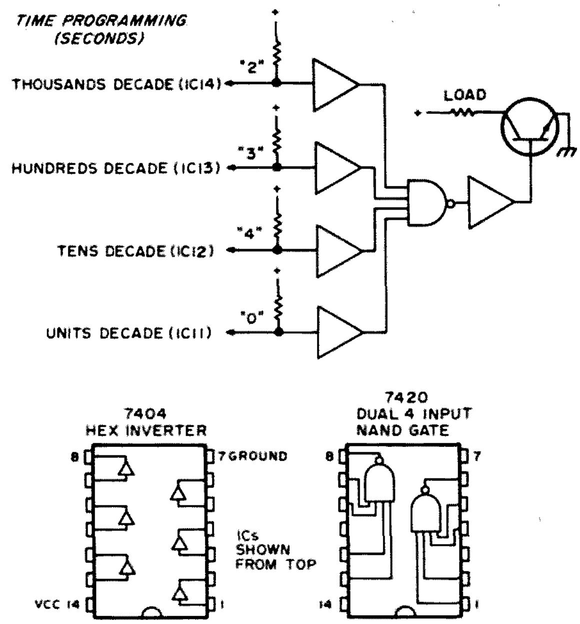


Fig. 1. Logic diagram of the basic timer module and base diagrams for the ICs used. One of these modules is required for each control function desired (on, off and the optional antenna control).

antenna were pointed to the NNE at an elevation of 45° it would maintain a full-quieting signal until the satellite was past its overhead position. This suggested that a single movement of the antenna (when the satellite was overhead), from 45° elevation to the NNE to 45° facing SSW, might be sufficient to maintain a reliable signal for the duration of a pass. This in fact proved to be the case with the additional bonus that this single movement "tracking" was sufficient for any pass falling within the "best pass window" previously described. The antenna is thus fixed in azimuth (NNE-SSW) and a single signal from the control circuits actuates an elevation rotor to accomplish the position change. Mercury limit switches, mounted on the antenna, cause the antenna to stop at the proper position. The antenna control unit, to be described, also provides for automatic reset of the antenna to its initial starting position at the beginning of a pass. In summary, after this lengthy introduction, we have a system, to automatically control the various station functions, that permits completely unattended satellite reception. It is thus possible to acquire satellite data on a daily basis for several weeks if need be with no manual intervention. In fact, the biggest problem I have in returning from a vacation is to find the time to read out all the pictures that have accumulated.

The Timer Module

I will use my own situation to outline some of the timing guidelines that need to be determined in achieving automatic control functions. Since the desired reception window is relatively narrow (± one hour from nominal overhead), the time factors can be determined on the basis of an overhead pass. First one has to decide how much of a pass is to be recorded. Since my time is limited and I am not likely to have time to read out more than a single picture each evening, I decided that 10-12 minutes of recording time per day would be ade-

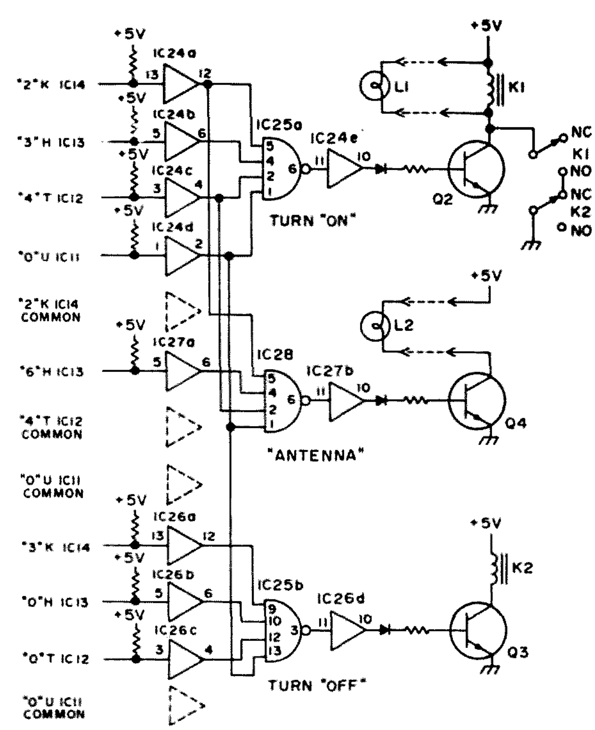


Fig. 2. The author's version of the timer module. Numbers in quotation marks refer to decimal outputs of the orbital timer board ICs indicated. Inverter sections indicated in dotted lines show sections that were eliminated because of common program values in that decade (see text). All resistors are 1000 Ohm, 1/2 Watt. IC24, 26 and 27 are 7404s. IC25 and 28 are 7420s. Q2-4 are HEP 53 or any g.p. NPN. Diodes are general purpose silicon switching (1N457, 1N914, etc.). K1 and 2 are 4.5 V dc SPDT subminiature relays (Calectro or equiv.). L1 and L2 are #47 pilot lamps remotely located at their respective photocell relay units. Component numbering is consistent with that of the satellite orbital timer.

quate. With the antenna system described it would be possible to acquire 15 minutes or more, but this would decrease the number of consecutive days that could be handled due to limitations in the amount of tape that could be loaded on the machine. If you will always read out the tape every day this is not a problem, but it does affect your ability to acquire pictures over an extended vacation trip. Ten to twelve minutes per day will permit a weekend of passes to be logged on a large reel at 7½ ips, while permitting several weeks of picture accumulation on a large reel at 1-7/8 ips. At my location, I can expect good signals 37-38 minutes after an equatorial crossing (AEC). I thus chose 39 minutes as the desired "turn on" time. The satellite will be overhead at roughly 44 minutes, and 50 minutes was chosen as the "turn off" time, giving a total of 11 minutes of recording. The orbital timer board of the satellite timer counts out the orbital period in thousands, hundreds, tens and unit seconds so the desired timing operations were converted to seconds:

Function	Minutes AEC	=	Seconds AEC
Station on	39		2340
Antenna change	44		2640
Station off	50		3000

It is then only necessary to develop a circuit to sense the desired time accumulation in the BCD to decimal decoders of the orbital timer board (ICII-14) of the satellite timer in order to achieve the desired control functions. In the simplest terms, when the desired time has accumulated in the orbital timers we want to trigger relays that will handle the appropriate control functions. Although the sensing circuits are simple enough, it turns out to be quite difficult to trigger control relays directly with the timer circuit, because switching loads on and off has an annoying tendency to scramble the count in the decade counters of the satellite timer, thereby throwing off the orbital clock. The circuit which I finally settled on triggers pilot lamps which are optically coupled to photocell relays, thus eliminating switching transients in the satellite timer.

Fig. 1 shows the logic diagram for the basic time sensing circuit. One of these circuit arrays or its equivalent is required for each function we wish to control. The circuit is designed to apply power to a load, either a lamp or a relay, whenever the desired count has accumulated in the four decades (thousands, hundreds, tens and unit seconds) of BCD to decimal decoders of the orbital timer board. The four input lines which establish the time programming are each routed through inverters whose inputs are initially held high by resistors connected to the +5 V line. As the programmed count is reached in each decade, the appropriate output of the decoder will go to ground, bringing its inverter input low, causing the output of the inverter to go high. The output of each inverter is connected to one input of a 4 input NAND gate. When the programmed time interval has accumulated, the output of the four inverters will be high, a condition that causes the output of the NAND gate to go from a high to a low. The output of the gate is routed through another inverter with the result that when the programmed time is reached the inverter output goes high, turning on a transistor and applying power to the load. In the example shown, the load would be activated when a count of 2340 seconds had accumulated in the decoders (ICII-14) of the orbital timer board.

Although one of these circuit arrays is required for each of the three functions we desire to control (on, off and the optional antenna control), the actual circuit can be simplified somewhat depending upon the program times chosen. If two or more functions share common digits in any decade, it is possible to eliminate some of the input lines and inverter sections as shown in the schematic of my control circuit diagramed in Fig. 2. The program times I happened to choose were:

"On" = 2340 seconds;
"Antenna" = 2640 seconds;
"Off" = 3000 seconds.

All these functions share a common requirement for a "0" input in the units decade while the "on" and "antenna" functions also share a requirement for a "4" input from the tens decade and a "2" input from the thousands decade. Rather than run separate

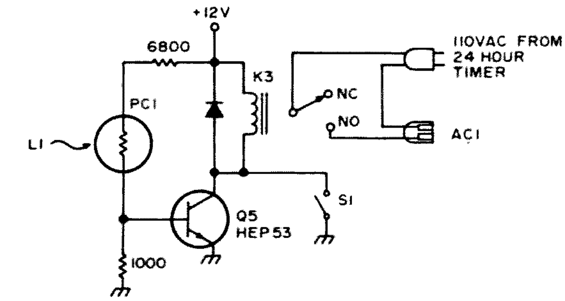


Fig. 3. Control module for the "on-off" station functions. L1 of the timer portion of the circuit is placed so that when it goes on it will shine on PC1, a cadmium sulfide photocell (Clairex type CL703 or equiv.). K3 is any 12 V dc SPDT relay. S1 is a SPST toggle switch, which serves as a manual control to activate equipment connected to AC1. AC1 provides power for all equipment which must be turned on and off, including the receiver, tape recorder, and the antenna control unit (if used). The 12 V dc must be available from a supply which is on at all times.

input lines and inverters for these common inputs, a single input line and inverter can be used with the output of the inverter driving the required gate inputs.

The "on" function operates as follows: When the programmed count of 2340 seconds accumulates in the decoders of the orbital timer transistor, Q2 will go on for one second, the time between the first register of a count of 2340 seconds and the point where the count goes to 2341 seconds. During this one second interval pilot lamp L1, which will actually control station operation, goes "on" and relay K1 pulls in. Once K1 has closed, the relay will stay on and the lamp will remain lighted even though Q2 goes off. This is achieved by connecting the collector of Q2 through the NO contacts of K1 and the NC contacts of K2 to ground. The "antenna" function operates in a similar fashion and will turn L2 on for one second when a time of 2640 seconds has accumulated. The turn "off" circuit comes into play at 3000 seconds when Q4 goes on for one second momentarily pulling in K2. This breaks the ground connection for the collector of Q2, causing K1 to open and L1 to go out. Neither will be re-energized when Q4 goes off, because Q2 has been off since 2341 seconds.

Thus L1 will be lighted for the desired station "on" interval and L2 will light momentarily when we want to move the antenna. As mentioned previously, these lamps are used to energize photo-relays to prevent aberrant counting in the satellite timer (caused by switching transients). The photo-relay circuit for the basic station control is diagramed in Fig. 3 and is about as simple as can be. L1 is remotely located in the photo-relay enclosure and is positioned so that it shines on a cadmium sulfide photocell when lighted. This lowers the resistance of the CdS cell, raising the base voltage on Q5 and energizing the station control relay, K3. It is this relay which controls the ac line to the station equipment we wish to control (receiver, tape recorder, etc.). Since L1 will come on for the programmed time during every orbit, we would waste a lot of tape during orbits where the satellite was not above the local horizon. This is circumvented by getting the ac to run the station equipment from a 24 hour timer set to go on at the start of the best pass window and off at the end of the window. This window is from 9-11 am local time in my own case. The window can be determined by setting the timer to come on one hour prior to the time of a nominal overhead pass and off one hour later. The many inexpensive 24 hour timers are inadequate for precision satellite timing but function well in this application, where all they are required to do is define the general period where reception is desired.

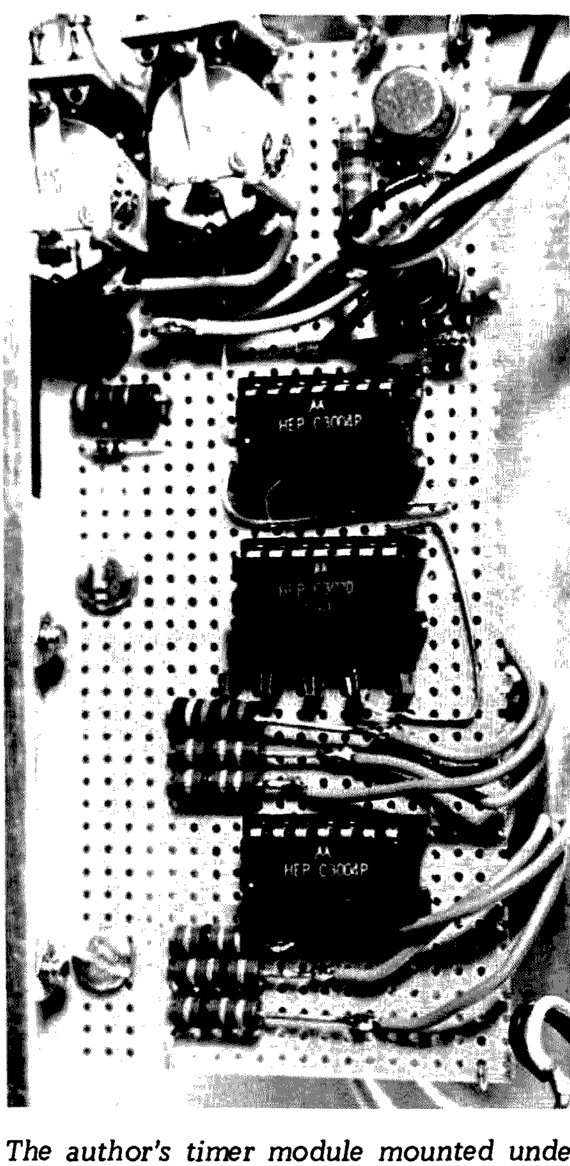
Construction of the timer module is easily accomplished using a small piece of perf board with 0.1" hole spacing to accommodate the IC sockets. One photo shows my own module mounted in the satellite timer. The relays specified for K1 and 2 are subminiature units and will mount on the board with the other components. Relays with higher current requirements should not be used, as the inductive "kick" when they are activated can cause erratic timer operation. Leads for L1 (and L2 if used) are run from the timer to the photo-relay enclosure.

The only requirement for the photo-relay circuit is that it be enclosed to protect PC1 from direct room light. L1 should be positioned so that it shines on the face of PC1; otherwise, layout is completely non-critical. A small barrier strip on the back of the enclosure can serve as a connection point for

the control cable for L1 and the 12 volts required by the relay.

The Antenna System

The name of the game in terms of the antenna installation is to install the yagi with a fixed azimuth bearing that parallels the overhead satellite track and use an antenna rotor to rotate the antenna between the two 45° elevation points. A CDE AR-20 rotor is used for this purpose. Complete rotors with conventional control units are widely available at very modest prices but it is often possible to obtain rebuilt rotor assemblies, at even less cost, from local distributors or TV service shops. A heavy metal plate and four heavy duty U-bolts are used to fabricate a right angle mounting plate for the support



The author's timer module mounted under the chassis of the satellite orbital timer.

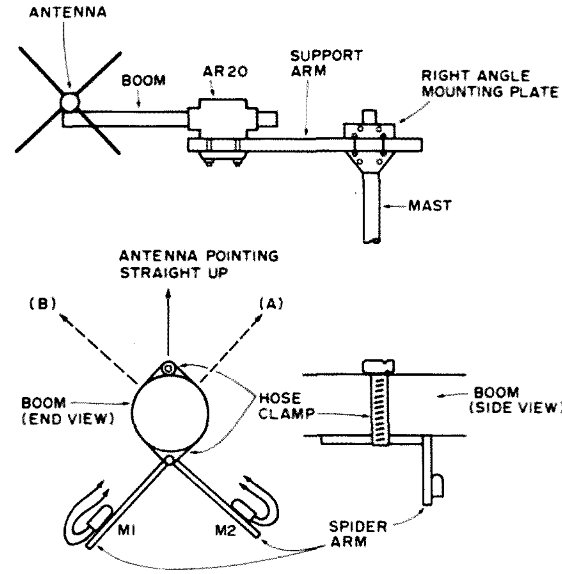


Fig. 4. Details of the antenna mounting assembly. The spider arm assembly holds the two mercury switches (M1 and 2) which serve as limit sensors. Styles of switches vary, but in all cases the contact end of the switch should face the bottom of the spider arm assembly as shown. The spider should be mounted as shown, with the antenna facing straight up. When the antenna is in the reset position (A), M1 should be open. When the antenna is in the advance position (B), M2 should be open. Antenna bearing is fixed by the adjustment of the mounting plate to the mast and should be tightened up so the long axis of the antenna parallels the direction of an overhead pass. The reset position points toward the origin of the pass, while the advance position points the antenna in the direction where the satellite signal is lost. Each spider arm should be 6-12" in length, with the switches mounted as close to the end as possible. Switch leads are dressed up to the rotor cable.

arm for the rotor. The rotor should be mounted on the support arm as close to the mast as possible to minimize stress on the mast. The photograph and drawing show the rotor mounted above the support arm. While it might seem mechanically superior to mount the rotor below the arm, this would give rainwater the opportunity to run down the rotor mounting bolts and pool in the housing. Mounted above the arm as shown, my own unit has been in service for over a year with no moisture problems. Before mounting the rotor it should be run to somewhere near the center of travel. The boom assembly, on which the rotor acts, carries the antenna, which initially should be tightened up so that it faces directly upward. As in the case of the support arm, the boom should be no longer than necessary, to assure

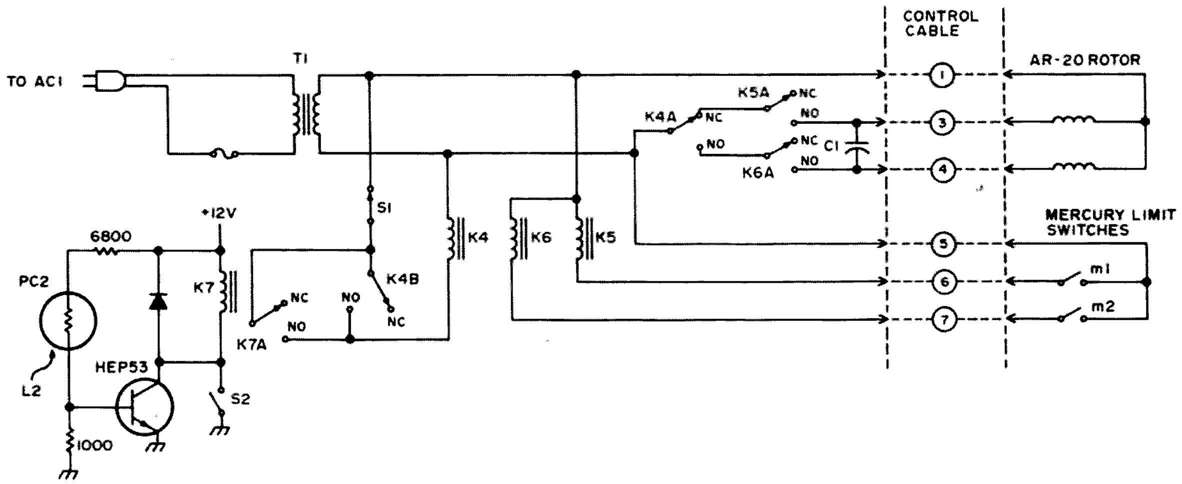


Fig. 5. Schematic of the antenna control unit. S1 — normally closed push-button switch (manual reset); S2 — normally open push-button switch (manual advance); T1 — 24 V ac 3 A filament transformer; K4 — DPDT 24 V ac; K5-6 — SPDT 24 V ac; K7 — SPDT 12 V dc; PC2 — Clairex CL703 (similar types available from Calectro or Radio Shack); C1 — 40 mF non-polarized (unit from AR20 rotor control may be used or a replacement 50040-10 may be ordered from CDE or a distributor). M1 and 2 are general purpose mercury switches. A wide variety of types are available from jobbers and appliance shops, and the glass types present no weatherproofing problems. The rotor cable connections to the AR-20 correspond to normal connections so the numbering of the rotor terminal strip can be followed.

that the antenna elements clear the mounting as the antenna rotates. Although the mechanical assembly looks rather ungainly, it has withstood without difficulty ice storms and winds in excess of 60 mph since installation. Sensing of the proper antenna position is achieved using two mercury switches (M1 and M2) mounted on a spider arm assembly constructed of aluminum rod. These arms are at right angles to each other and, if clamped to the boom as shown (Fig. 4) with the ant nna in a vertical position, they serve as sensors that the antenna has reached the desired angle. Angle A, where the antenna is in the reset position, as it would be at the start of a pass, will result in switch M1 being horizontal aand thus off, while M2 is vertical and on. With the antenna at angle B, the advance position at the end of a pass, M2 is now horizontal and off while M1 is vertical and on. Leads from M1 and M2 are dressed up along the spider arms and back along the boom to the rotor cable. As shown in Fig. 5, one lead from each switch is tied to a single conductor (#5) of the cable while another lead from each switch is run to a separate conductor.

Antenna Control Unit

The antenna control circuit (Fig. 5) looks complex, but it is actually a fairly simple-minded switching arrangement. The direction of movement of the AR-20 rotor is determined by which of the two motor windings is directly actuated by ac from the power transformer. Let's assume for the moment that the antenna is up on the roof pointing straight up the way we left it. If we supply ac power to T1, simulating a station activation, T1 will provide 24 V ac to energize both K5 and K6 through M1 and 2 respectively, since both mercury switches are closed with the antenna in a vertical position. K4 remains open when power is first applied. T1 also supplies ac to the common rotor lead *and* ac to conductor 3 of the rotor cable, through the normally closed contacts of K4 and the normally open contacts of K5. This causes the rotor to move in a counterclockwise direction, rotating the antenna away from the vertical to the NNE. When it reaches 45° elevation, M1 on the spider arm assembly up at the antenna will open, dropping out K5 and removing power to the rotor. The antenna thus stops at 45° elevation — in the reset position. All of this only takes a few seconds after power is applied. If the antenna is in the advanced position or any intermediate point, it will always move to the reset

position when power is first applied at the start of a pass. If the antenna is already in the reset position at the start of a pass, K5 will be open and the antenna will remain in that position. In the case of my own programming, all of this occurs at 39 minutes after an equatorial crossing that falls within the reception window. Five minutes later, at 44 minutes after the crossing, L2 will be momentarily activated by the control module. This will momentarily pull in K7 in the antenna photocell relay circuit, which in turn energizes K4. When K4 pulls in, two things happen simultaneously. One set of contacts (K4B) locks up K4 so it stays pulled in, even though K7 drops out, and the remaining set of contacts (K4A) now route power to the other rotor winding (conductor #4 of the rotor cable). K6 is still closed, since M2 is closed in the reset antenna position, so the rotor will begin to move in a clockwise direction until the antenna reaches 45° elevation to the SSW – the advanced position. At this point M2 opens up, dropping out K6 and stopping the rotor. Since K4 is still locked up, the antenna will remain in this position until the end of the pass when power drops out at AC1. The power dropout causes K4 to open. Since M1 is closed in the advanced position, as soon as power is applied at the start of the next pass, usually the next day, K5 will close and the antenna will reset to its starting position. S2, which is used to manually advance the

NOAA-4 photo of eastern Canada and the northeastern US in the grip of winter. The southern tip of Hudson's Bay (James Bay) is visible in the upper left, while the Gulf of St. Lawrence, the Gaspe, New Brunswick, Nova Scotia, and Maine are visible in the upper right half of the picture. Snow cover outlines the northern east coast of the US, highlighting Cape Cod and Long Island. Inland portions of the Great Lakes can be seen under low cloud cover.

antenna, merely functions to cycle K7. Momentarily pushing S1 will reset the antenna if it is in the advanced position.

Despite its apparent complexity, the antenna control unit goes together very quickly, particularly since plug-in relays are used with screw terminal sockets. Before attempting to put the unit in service, you should set up the control unit, rotor, boom and limit switches in the shop, to verify the proper movement of the rotor and the function of the limit switches. The connections shown for the AR-20 assume that the rotor support arm will come off to the left of the mast (facing in the direction of the origin of a pass). This arrangement requires that the rotor move clockwise (viewed from the top) when advancing and counterclockwise when resetting. If it does not move in this way, or you require the opposite direction of movement for your mounting arrangement, simply reverse the connections to conductors 3 and 4. I use a barrier strip on the rear of the control unit to handle connections to the multiconductor rotor cable.

With the rotor mounted horizontally (as it will be on the roof) and the boom arm in place, the mercury limit spider arm assembly should be mounted so that each of the arms is below the boom and at an angle of 45° to the vertical. The rotor itself should be somewhere near its center of travel for this test. A small wooden pointer can be mounted at the end of the boom (facing straight up) to simulate the antenna. Plug the 110 V ac plug into an outlet and the pointer should swing to the reset position and stop. Momentarily press S2 and the pointer should swing around to the advance position. Pressing S1 should reset the pointer. Momentarily applying 5 V to L2 should cause the antenna (pointer) to advance. Pulling the ac plug and re-inserting it should cause the pointer to reset. If all these tests are satisfactory you are ready to lug the whole assembly to the top of the roof and replace the silly wooden pointer with a real antenna. This ground check is highly desirable since if you miswire a relay you can cause a real tangle of coax and cable up on the roof.

. . . WB8DQT

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Eskimo Pie

Fan letters from SWLs used to be a mixed blessing. Sure, it took time and postage to answer them. But occasionally one would drift in that was amusing and, at times, unforgettable.

Somehow, sideband has squashed most of these guys out of the picture. When we were on AM on the DX bands, ears all over the world hung on our words. No more.

Until the SWLs get and/or learn how to use SSB receivers, the great silence may continue — and we'll save considerable postage. But I predict the floodgates will open one day again. Human nature, events and history have a way of repeating . . .

Apparently fed up with people, the Queen was not in much demand as a baby sitter.

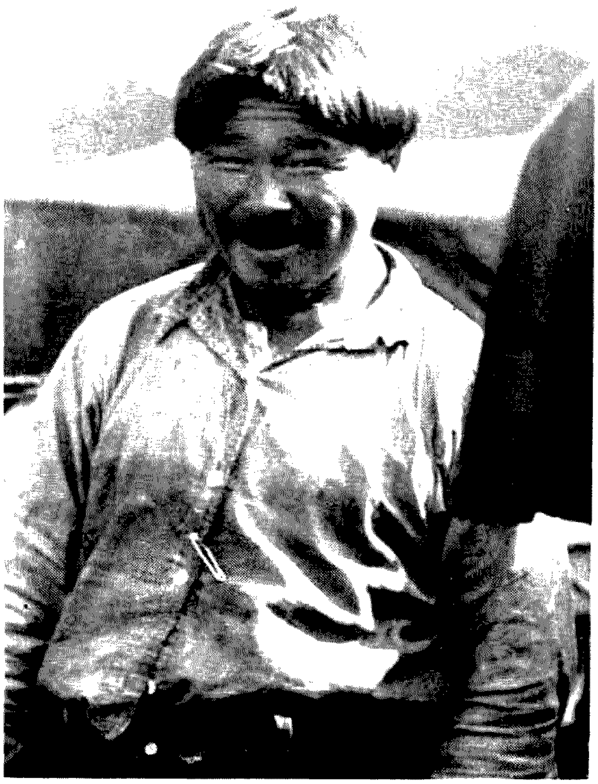
Take, for example, a wild letter I received with photographs many years ago from a Catholic missionary, a German by the way, whose beat was way out yonder in the Canadian Arctic. He was associated with "the flying priest," Father Schulte — and decided after listening to my multi-language QSOs with hams in Europe that I was the guy to develop his hot story for the world to learn. Believe me, it was a shocker!

It seems that this tasty item related to His Majesty IKTUKSHAKDGUK, Eskimo King of Iglooluk, and his charming wife, the Queen — permanent igloo address not revealed. Anyhow, judging by the photos, you will note from the King's nonchalance and the Queen's obvious *savoir-faire* that they were indeed unusual people.

My missionary SWL outlined in his fine German script — translation of which was not too easy — that I should "feed" the story to Life magazine, or some other great American publication. For various reasons, I never got around to it. So now 73, which is not a bad publication at all, may do the honors.

If you have a queasy stomach or don't like to bite off more than you can chew, perhaps you'd better look away and not read on. Otherwise, "press on regardless . . . "

"It seems that our Queen ate her first husband and two babies some winters ago," my holy friend divulged. "She allowed that



Eskimo King IKTUKSHAKDGUK had "just one eye more for his sweetie pie."

he was a tough husband. He did not provide enough food for the family . . ." It was that simple.

The letter continued, "The King seems happy, however, he has only one eye more. He calls her sweetie pie."

My wife (XYL to some of you guys) observed, "The Queen obviously looks ahead – but with those two sharp teeth and two wedding rings on the wrong hand she is undoubtedly dreaming up a savory new recipe for Eskimo pie. I wouldn't trust her. The safety pin on his shirt, backed up by those solid looking buttons, only stresses her desire to meat, I mean meet, Eskimo standards of good taste – in dress of course. At least, he doesn't appear to be in any big stew about it – at the moment."

Let's hope that the old gal has reformed, if she is still navigating. She could even be the head of her local PTA. However, dis closure of her former diet could annoy the lady if she has continued to forage around, as above. She might even come down here and give us a hard time. Oh, yes. As the French say, "Bon appetit." . . .W1BNN

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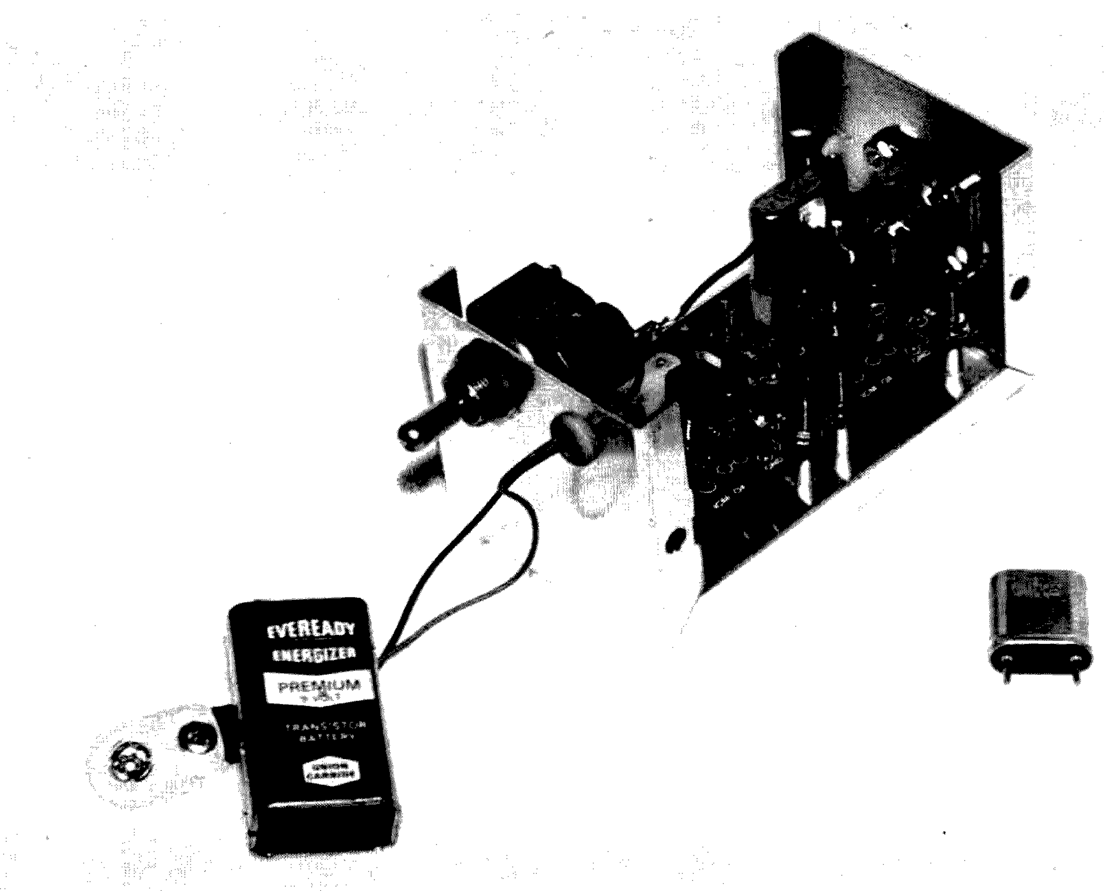
FM Alignment Oscillator

Surplus commercial transceivers still provide the most economical means of getting started on the amateur FM bands. Often, however, these rigs require considerable "tweaking" to bring them into our bands. An rf signal source to align the i-f and rf sections of the receiver is almost always required to accomplish tune-up.

This article describes a simple test oscillator built around the ever popular International Crystal "OX" oscillator board. Two oscillators provide a 10.7 or 21 MHz signal for i-f tune-up and a low level signal for rf section alignment. The crystal selected for rf alignment is in the range of 6 to 10 MHz – a harmonic provides output on the operating frequency. I chose the 24th harmonic for two meter work, and have sucessfully tuned several 430 MHz rigs utilizing the 50th harmonic of a 9 MHz EX crystal. This allows an "OX-LOW" oscillator to be used in both sections of the test unit.

Construction

The unit consists of a 5x2½x2½" minibox with a S0-239 coax jack and a SPDT switch mounted in opposite ends. The



The complete test oscillator. Note link from OSC1 to OSC2. I-f crystal should be used in OSC1, closest to switch.

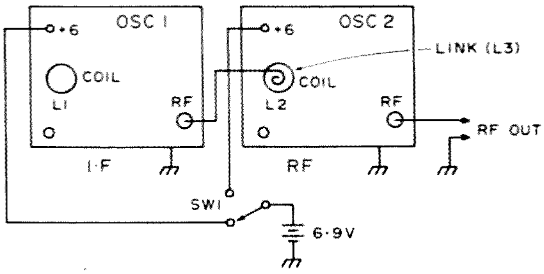


Fig. 1. Block diagram. Link consists of 2 turns #18 around L2; cold end of L3 is not grounded. SW1 is a center off SPDT.

two OX oscillators mount side-by-side with the supplied hardware. The rf output of one oscillator is directly connected to the output jack, with the second link coupled to the coil of the first with two turns of #18 insulated wire. This prevents the output of one oscillator being shorted by the other. The switch selects the oscillator to be powered by an external 9 V battery.

Operation

The i-f crystal should be placed in the link coupled oscillator, as the strong fundamental output is utilized. When using the high frequency harmonic, directly couple the test unit output to the antenna of the rig. When the rf section is rough tuned, the oscillator is moved across the bench with a 10" section of wire serving as an antenna. The noisy (not fully limiting) signal is then used for fine tuning of the receiver.

Although the EX crystal is of low accuracy (by FM standards) I have never found a case where tweaking the receiver first oscillator trimmer did not tune the harmonic, even in the case of the 50th harmonic used for 430 MHz units.

The EX crystal frequency for the FM bands may be determined as follows:

144 MHz-Fx=Fo/24
220 MHz-Fx=Fo/20
430 MHz-Fx=Fo/50

where Fx=frequency of EX Low crystal, and Fo=receiver frequency.

I have found this unit to be an invaluable aid in tuning a variety of surplus rigs. Once the rough tuning is complete, the rig may be "netted" by monitoring another ham or the output of your local repeater and zeroing the discriminator.

. . . WA3ETD/2

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Master Sync Generator

This master sync generator is designed to produce interlaced sync for a black and white camera at minimum complexity and cost. The heart of this circuit is an IC made by Texas Instruments for the '74 series of Sylvania color TVs.

This IC, Sylvania part number 15-37701-1, is a ÷2, a ÷525, and a singleshot all-in-one 14 pin dip IC. The list price is $5.40, and the net price is proportionately lower. This IC was designed so that the TV set generates its own sync signals if off the air sync is temporarily lost.

By putting in a 31.5 kHz signal, and adding a singleshot to the horizontal output lead, interlaced sync results. My method of getting 31.5 kHz is shown. I had a surplus 6300 kHz xtal in the junkbox, so I followed it with a ÷200 set of flip flops. Many other combinations of xtal and dividers would work fine, such as 3150 kHz and ÷100, 504 kHz and ÷16, etc., or you can pay the long dollar for a 31.5 kHz xtal.

. . . WØLMD

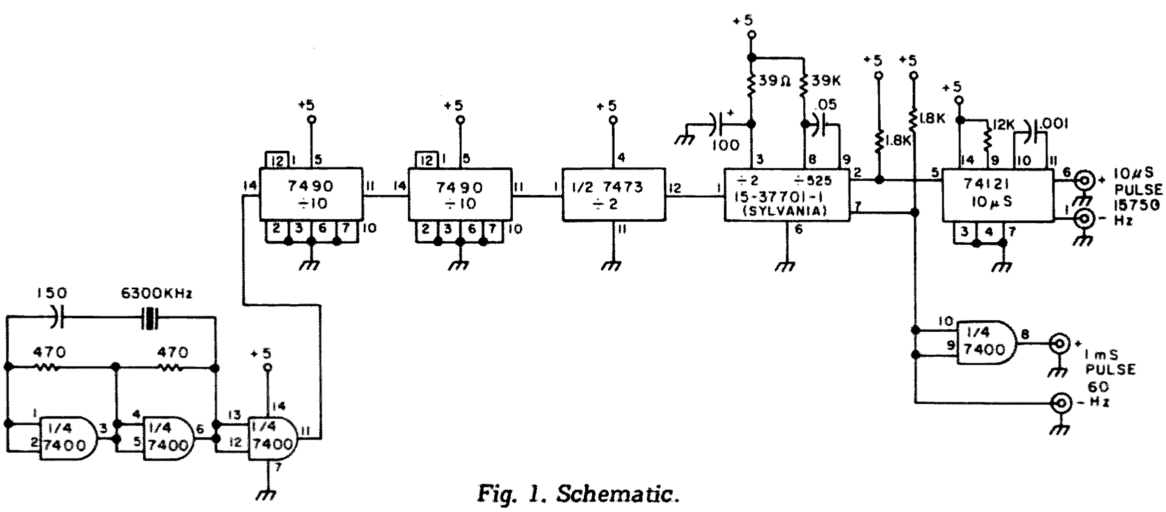

Fig. 1. Schematic.

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The Audio Synthesizer for RTTY, SSTV, and whatever

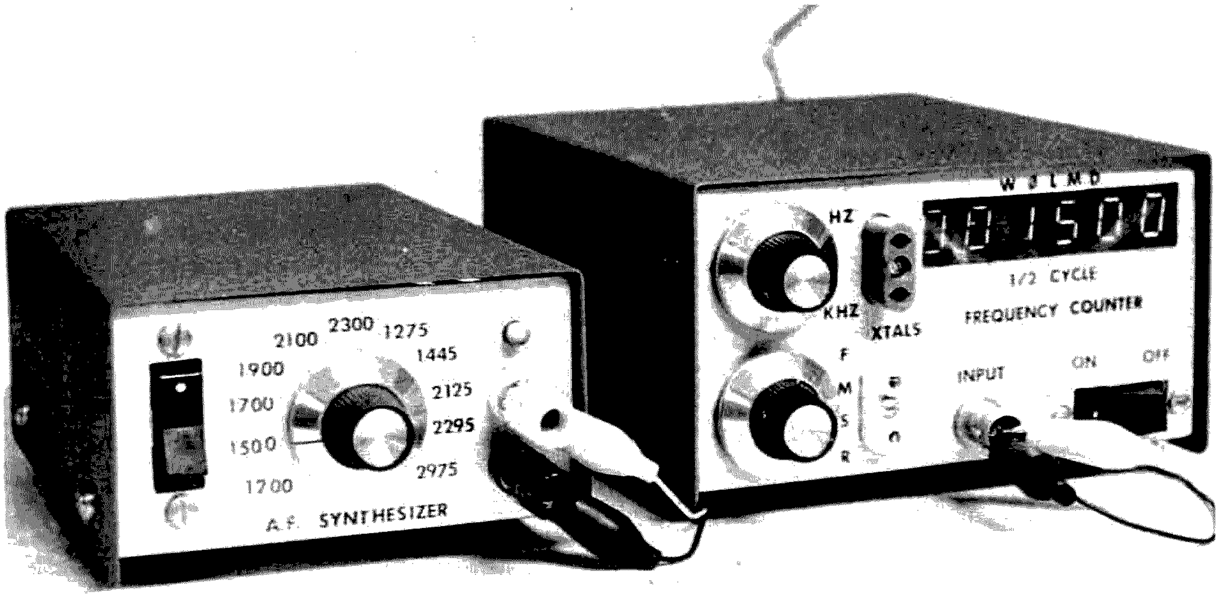
Have you ever had a need of an audio generator for precisely tuning your SSTV or RTTY equipment? This audio frequency synthesizer generates highly accurate tones useful for tuning both SSTV and RTTY station equipment. The output frequencies are within .4 Hz of the exact desired frequency of 11 tones critical, or very helpful in the tuning of an SSTV or RTTY station. A single crystal is subdivided to derive the desired tones, and the complete unit can be built for less than $20.

The frequencies considered critical to SSTV tuneup were 1200, 1500 and 2300 Hz, representing Sync, Black and White respectively. In addition, 1700, 1900 and 2100 were considered useful for grey scale adjustments of SSTV, so these were added, resulting in six synthesized frequency requirements for SSTV.

RTTY has five frequencies which can be considered critical to tuneup. These are 1275, 1445, 2125, 2295 and 2975 Hz. These are the five tones which may be utilized on either wide or narrow frequency shift keying, using the low or high tone set.

Theory of Operation

The af synthesizer starts off with a simple crystal oscillator feeding three synchronous binary counter ICs. Since each IC has four stages, a possible frequency division of 2^{12}



Af synthesizer on left, with frequency counter on right showing resultant output.

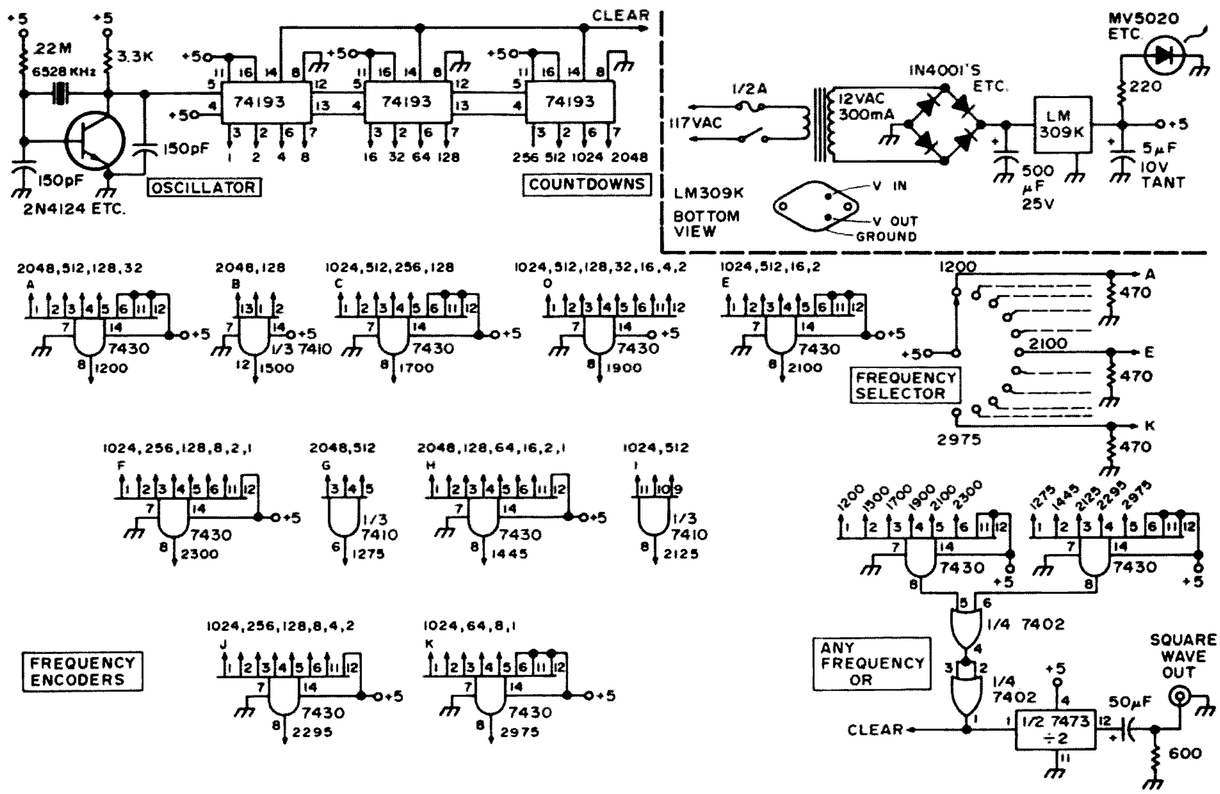


Fig. 1. SSTV and RTTY frequency synthesizer.

or 4096 exists before the counters carry to Ø. However, if the proper outputs are gated together, the counters can be reset prior to 4096, thus establishing control of the exact frequency division. As shown on the schematic, by sequentially labeling the outputs of the counters in powers of 2, the desired frequency division can be easily assembled. The problem then becomes one of getting the simplest gating combination for the desired accuracy.

A rather complex computer program was written to analyze the problem stochastically, and the relevant portion of the printout is shown in Table 1.

The computer did in a few minutes what would take years of manual calculation and comparison. Eleven NAND gate decoders are wired to detect a 1 bit at every input to produce a Ø bit at the output of one of the decoders, the decoder of the selected frequency to be synthesized. This Ø bit at the output of any decoder then produces a 1 bit at the output of the OR section, resetting the divider section, and also toggling the output flip flop.

The various NAND division decoders are selected by a switch which puts a + enabling voltage on one input of the desired frequency's decoder. If remote manual, or electronic selection, is desired, such as a grey scale pattern for SSTV, or AFSK for RTTY transmission, the builder merely has to supply a + voltage to the desired decoder selector input in the sequence and/or for the time required.

Since the calculated frequency has been doubled, then halved in the output flip flop, the output waveshape is a symmetrical square wave, excellent for tuneup and calibration, but poor for transmission. If you wish to transmit this signal, build a low pass or bandpass filter to convert the output to a sine wave.Those not needing either SSTV or RTTY synthesis can omit the unneeded decoder NANDs, the 7430 OR gate associated with the undesired block of decoders, and the 7402. The remaining 7430 in the OR section is then directly connected to the 7473 and the Clear line.

Construction

I built the af synthesizer as a self-contained unit having its own power supply. The cabinet is a Radio Shack #270-252 measuring 4" wide by 2-3/8" high by 6" deep. The power transformer is any 12 volt

ac 300 mA or more unit that you may have around.

The actual IC board is a perfboard unit with .1" center holes measuring 2½" by 4½". The ICs and other parts are inserted and then the tedious wiring with #30 wire and a small, fine tipped soldering iron begins. Since it is very easy to make a mistake, be sure to develop some kind of a wiring system, such as labeling the ICs and wiring similar sections sequentially.

It is easier to build if an ordered process is followed which will allow progressive testing. Complete and test the power supply first. Next wire up power pins of all the ICs and build the crystal oscillator. After you have verified proper oscillation, wire up the three frequency dividing ICs, and temporarily ground pin 14 of these three ICs. Look at pin 7 of the last 74193 with an oscilloscope. If everything is working correctly so far, you should see a square wave, 1593.75 Hz in frequency.

Start wiring the decoders by wiring the 7430 labeled "1200." Reading the abbreviated schematic, you will find that the 1200 Hz decoder requires a 2048, 512, 128 and 32 bit input to pins 2, 3, 4 and 5 respectively. The 2048 and 512 bits come from pins 7 and 2 of the third 74193, and bits 128 and 32 come from pins 7 and 2 of the second 74193. Pin 1 of the 1200 Hz decoder is connected to "A" (the 1200 Hz position of the switch). The output of the 1200 Hz decoder (pin 8) is connected to the 7430 OR gate NAND associated with the SSTV frequencies, the 1200 Hz decoder input, pin 1.

Then wire the other connections to the OR section, except do not connect the OR inputs to the unwired decoders yet. Remove the temporary ground from pin 14 of the 74193s and connect the OR section output as shown on the schematic to the pin 14s of the 74193s and the input pin of the output ½ 7473.

Select 1200 Hz on the switch, and the output of the synthesizer should now read 1200 Hz, ± one digit, on a frequency counter. Now wire the rest of the frequency decoders and test each one. If any selected output does not read out correctly on the counter, you either have an error in your wiring, or a defective IC. Or maybe a bum counter!

Extending/Modifying The Af Synthesizer

The unit can also synthesize other frequencies between 800 Hz and 3264 kHz with varying degrees of accuracy. The lower the desired synthesized frequency, the greater the probability that the resultant output will be very close. A number of extra, currently unused, input gates in the OR section are shown on the schematic. These can be connected to additional decoders, and additional switch positions will allow selection of up to 16 synthesized frequencies.

Suppose you wish to add 1000 Hz output. First use the following formula to derive the frequency division needed:

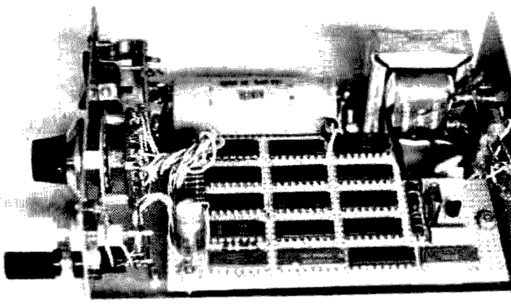
Division required =

$$\frac{3264000}{\text{Synthesized Frequency Desired}}$$

Entering our desired frequency of 1000 Hz we get:

3264000	SSTV 2720.00	2176.00	1920.00	1717.89	1554.29	1419.13		
	RTTY 2560.00	2258.82	1536.00	1422.22	1097.14			
2720	1200.0000	2048	512	128	32	0	0	0
2176	1500.0000	2048	128	0	0	0	0	0
1920	1700.0000	1024	512	256	128	0	0	0
1718	1899.8836	1024	512	128	32	16	4	2
1554	2100.3861	1024	512	16	2	0	0	0
1419	2300.2114	1024	256	128	8	2	1	0
2560	1275.0000	2048	512	0	0	0	0	0
2259	1444.8871	2048	128	64	16	2	1	0
1536	2125.0000	1024	512	0	0	0	0	0
1422	2295.3586	1024	256	128	8	4	2	0
1097	2975.3874	1024	64	8	1	0	0	0

Table 1. Computer printout of frequency synthesis combinations.



Inside view.

$$3264 = \frac{3264000}{1000}$$

Next, we determine the binary divisions required. Sequentially subtract the highest binary number listed on the 74193 outputs, in descending order:

$$3264 - 2048 = 1216 - 1024 = 192 - 128 = 64 - 64 = 0.$$

This indicates that a decoder connected to the 2048, 1024, 128 and 64 outputs of the 74193s will give a 1000 Hz synthesized output from the af synthesizer when selected.

A problem comes in when the division required is not a whole number. In this case, the division required is rounded off to the nearest whole number, but some resultant inaccuracy will have to be tolerated, or a new computer analysis can be run, using this new desired frequency as another simulation constraint.

Table 1 shows several examples of how the computer listed the resultant error for me. The first number on the top line was the stochastically selected master frequency. The SSTV and RTTY frequencies required the 11 division ratios shown to the right of the master frequency. 2100 Hz actually required a division of 1554.29. The computer rounded off to 1554 beneath, and then calculated the resultant frequency and the required binary divisions. Notice that the 1554 division results in a frequency .3861 Hz too high, but this is close enough for my application so the design was accepted.

Another consideration is that a 7430 has only 8 input legs. Since one input goes to the switch, each decoder must use a maximum of 7 input legs to the counters. This was another variable entered into the computer as a design constraint. Note on the printout of Table 1 that only one decoder (1900) required all 8 inputs. Synthesized frequencies requiring only two counter inputs can use a 1/3 7410 as shown, and those requiring only three can use a ½ 7420, in the interest of lowering the total IC count.

Conclusion

This project has presented an af synthesizer for SSTV and RTTY frequencies which is accurate to within .4 Hz, in the worst case. A computer was utilized to obtain the needed data for building a unit which gives the required accuracy, as well as minimizing the complexity of the unit. The output is a symmetrical square wave.

Subsequent computer simulations have been run for af synthesizers which synthesize a sine wave output of the desired frequencies of SSTV, RTTY and SSTV and RTTY. These designs will be written up at some later date.

. . . WØLMD

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Ham Radio in the Arctic - 1925

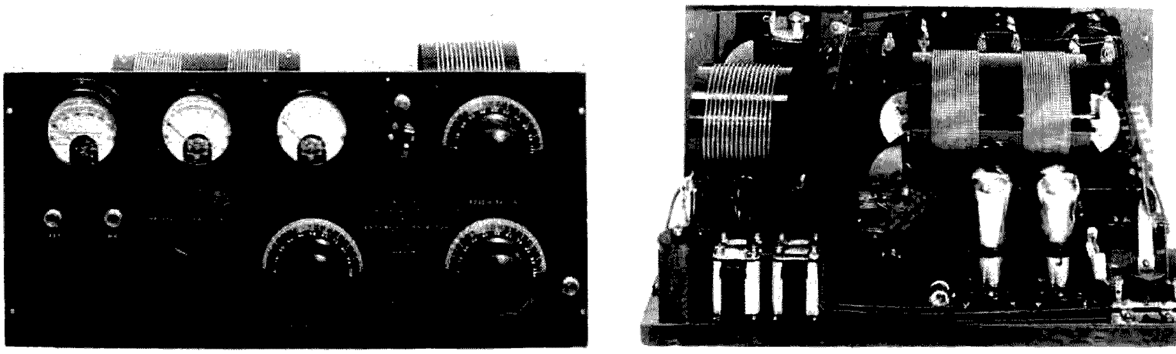
Just fifty years ago, in the summer of 1925, Commander Donald B. MacMillan led an expedition to the Arctic, to search for land masses near the Pole. His previous expedition in 1923-24 had been smaller, but he had set a precedent by equipping his schooner *Bowdoin* with amateur radio gear with the call WNP (Wireless North Pole), and enlisting Don Mix as operator. Although only one Canadian amateur was able to work them with any regularity, WNP was the most talked-about event of the year. From that time, no geographic expedition was complete without radio to keep in touch with the outside world.

MacMillan's 1925 plans were more ambitious. He was sponsored by the National Geographic Society and he had two ships, his favorite *Bowdoin* and the converted French trawler *Peary*. The *Peary* carried a group of three Navy amphibian aircraft commanded by Richard E. Byrd. The radio gear, as in the first expedition, was custom-built by Zenith; in fact, E. F. MacDonald, Zenith's president, was MacMillan's second in command.

What made this expedition so important to amateur radio? Short waves! The equipment was made to operate all the way to 20 meters, a relatively uncharted area in the days when most activity was around 200. A few amateurs had conducted experiments at 40 and 20, notably John Reinartz 1XAM/1QP, and had noted that these bands were especially suited to daytime work. The expedition would be in continuous daylight during the Arctic summer, and the 200 meter band would be nearly useless, as the first expedition and WNP had shown.

On the basis of these short wave experiments, 20 meters was chosen as the primary traffic frequency, and QST expressed the hope that as many amateurs as possible would build suitable rigs to work MacMillan. Reinartz himself, one of the few men familiar with the construction and operation of short wave apparatus, was engaged by

John Reinartz 1XAM/1QP, at the base camp in Etah, Greenland. (Photo copyrighted by the National Geographic Society.)



The author's 40m Reinartz-Zenith transmitter-receiver. (Photos by Robert H. Macdonald.)

Zenith to design the necessary radio gear, and to accompany MacMillan as chief operator. He was already famous for his "Reinartz circuit," a peculiar form of regenerative tuner that was immensely popular in the 1920s.

Though I have no first-hand information (I was born almost twenty years later), I'm probably not sticking my neck out too far if I speculate that the chance to hear and work MacMillan directly was enough to convince many hams to get out of their 200 meter ruts and make the jump to short waves. Did someone mention "incentive"?

My own interest in MacMillan's work began when I had the good fortune to buy one of the few existing pieces of gear that he used, from the man who had owned it ever since the expedition returned. This 40 meter transmitter-receiver was installed on one of the aircraft, for emergency use in case of forced landing. The receiver is a Reinartz

These snapshots were taken by Donald Whittier, a Maine amateur, when the first expedition returned in September, 1924. They hung among his QSL cards for many years.

detector and two-stage audio amplifier using type 99 tubes. The transmitter runs 3 to 5 Watts to an 01-A tube and can be Heising-modulated by another 01-A for phone. The receiver covers 6-11 MHz and works quite well, even on today's crowded band, helped by the filter action of my Baldwin phones that resonate at 1000 Hz. The transmitter has a fearsome chirp at anything above 500 mW input, but I'm told this was normal in those days.

Geographically speaking, the expedition was a flop. The summer was unusually short, and the areas of open water, where the aircraft could be landed, never developed. This made flights far to the north and west of Greenland out of the question, as a landing on the rugged ice would have meant a crash. Furthermore, the short summer left only 15 days for flying, most of which were poor. Still, the planes logged 6000 miles and did explore a large part of Greenland's interior. For detailed accounts of both expeditions, refer to *National Geographic*, June and November, 1925.

... DOUGLAS

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Pack Rat Moonbouncing

A long standing desire of the Pack Rats was fulfilled Friday night, February 21, 1975, when the Pack Rat Moonbounce station became operational. It has been a long time since the first organizational meeting at the home of Chuck Benavides WA3LNH (now WA1KIR) in the winter of 1973, when the 432 MHz band was agreed upon as the best band for the project. Much work was required, since almost no equipment was available of moonbounce quality or capability. The donation of a twenty foot stressed dish by Allen K2UYH provided a shot in the arm, but still the high power transmitter and low noise preamps required were only dreams.

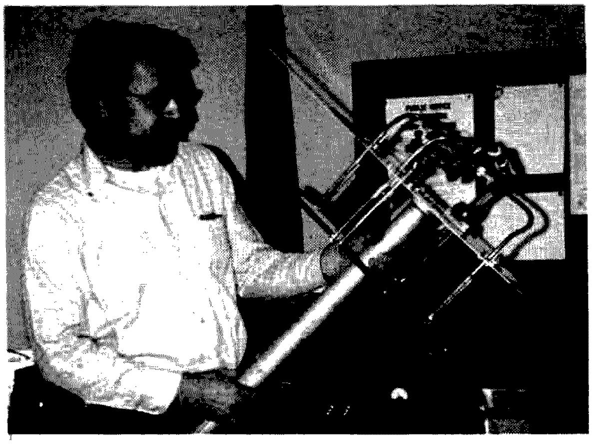
Little by little progress was made. Two high powered amplifiers were built and tested by W3HMU and K3BPP. A few low noise preamps were built and tested – most worked only fair and gave problems of oscillation or cross-modulation. Modern filter designs and preamp circuits were tried with eventual success. Although the bits and pieces were taking shape, the pressure of contests and other club activities took priority due to the urgency of their schedules.

An injection of fresh enthusiasm in the person of Bill W3HQT got things rolling. Bill decided this past fall that the time had come to start assembly of the dish and that his backyard could be the location for the W3CCX moonbounce station. After some time off for the January Contest, word came from California of the plans for moonbounce tests using the Stanford Research 150 foot dish. This gave us the final push. It was decided to be ready to operate during the tests scheduled for the weekend of February 22 and 23. The twenty foot dish was re-assembled and covered with new chicken wire during the coldest part of the winter. Several times the dish crew worked in the rain, because rainy weather meant mild temperatures. The chicken wire covering was completed Saturday, February 15, by head chicken wire plucker W3HQT, assisted by W3HMU and K3BPP. Notable contributions to the dish construction were made by WA3NGK and WA3JUF.

February 16 was dish mounting day. The mount had been positioned in the ground behind the barn in early January before the ground froze. A brute force technique reminiscent of past June contest operations was used to place the dish on its mount. The dish was lifted into position by "dish chief" W3HQT and K3BPP, with WA3NGK, WA3AXV, WA3JUF, W3HMU and K3ZSG providing additional muscle. During this operation, K3ZSG found that his Vietnam boots were no match for the combination of snow and sheep droppings in the barnyard. The dish sure looked impressive when we stepped back to see the results of our labor!

The week of the 17th of February saw completion of the details of the major station equipment, some of which were presented at Pack Rat Home Brew Night,

Reprinted from *Cheese Bits*, Mt. Airy VHF Radio Club, Inc., Philadelphia PA, March, 1975.



K3BPP with the feed.

Thursday, February 20. Friday night the station was assembled into the new room W3HQT had built into one corner of his barn. Although an attempt was made to calibrate the receiving set up on sun noise before sunset on Friday, the attempt was foiled by cantankerous BNC connectors which caused problems that were not resolved until after sunset. The weather was good, although the temperature dropped quickly after sunset with a clear sky and the moon in full view. The moonbounce station was on the air by 11 pm and testing was begun to see if we could hear our own echoes off the moon.

After only a few test transmissions Al K2UYH called to tell us he was hearing our echoes quite well and to look about 1 kHz below our frequency for the echoes – which were shifted due to Doppler effect. With this information we then heard our own echoes – quite weak but definitely there! To have heard our echoes on the first night was more success than we had dreamed possible. We then copied a portion of a moonbounce QSO between K2UYH and WØOQI. WA6LET was copied Q5 at about 2 am calling CQ, but not responding to calls.

About 3 am Saturday morning the crew ran out of steam and shut down operations. Saturday afternoon was perfect for antenna and receiver tests and adjustments. Initially 4 dB of sun noise were measured, indicating something wrong. The problem turned out to be a mis-tuned input filter. Seven dB of sun noise were measured after adjusting the filter. Antenna patterns were studied using a signal source and some improvements made to the mount alignment and antenna supports. Two bore sights were mounted and adjusted so that when the antenna was peaked on the sun, the sun was centered in the sights. Setting circles (basically protractors used in measuring antenna orientation) were mounted on the antenna frame and calibrated on the rising moon by boresighting the moon and adjusting the setting circles to the values of azimuth and elevation in the moon table sent to us by K2UYH. Using these setting circles, it is possible to point the antenna at the moon when the moon is not visible.

Moonbounce operations were begun around 6 pm on Saturday evening with good echoes being received. WA6LET was heard calling CQ around 7:15 and was worked with 559 signal exchanges both ways. The crew then broke for a victory cup of Red Zinger. Further echo tests and a CQ brought a phone call from WØYZS and KØTLM of Kansas City MO, who were hearing us off the moon and wanted a schedule. Both stations were worked on schedule around 10:30 pm. After listening around for awhile the station was secured at midnight.

Sunday evening was extremely foggy with occasional light rain. Not very good weather to be outdoors. W3HQT and K3BPP, who were working on the moonbounce shack, decided to try for echoes using the elevation

W3HMU with the amplifier.

and azimuth calibration circles mentioned earlier. They were soon joined by me. The dish was pointed at the non-visible moon according to the moon tables, and, lo and behold, back came echoes! We then listened in on the moonbounce schedules between W1SL and W4NUS. W1SL was pretty good copy and W4NUS was detectable. After the sked we called W1SL via the moon. Not hearing any return we decided to call him on the telephone and arrange a schedule. Tom was some time in coming to the phone because he had heard our call off the moon and was busily calling us back! A schedule was quickly arranged and W1SL was working in due course. Our first weekend on moonbounce had netted four QSOs and three states worked. Certainly most satisfying for the above-mentioned group, who had worked so hard and long.

The following is a run down on the equipment used at the W3CCX moonbounce station. The equipment is arranged in order of signal passage when listening to echoes.

Transmitter

Brass Hand Key or CQ de W3CCX/3 code wheel – home brew K3UJD;

432 MHz exciter 100 W – home brew W3HQT;

Power amplifier 8938 – home brew W3HMU;

7/8" air dielectric coax – connectors from W3NGK (saved the day).

Receiver

FMT 4575 preamp 1.7 dB NF – home brew (W1JAA design);

1/2" foam-flex coax – Pack Rat special purchase;

2N5652 preamp 3 dB NF – home brew (W1JAA design);

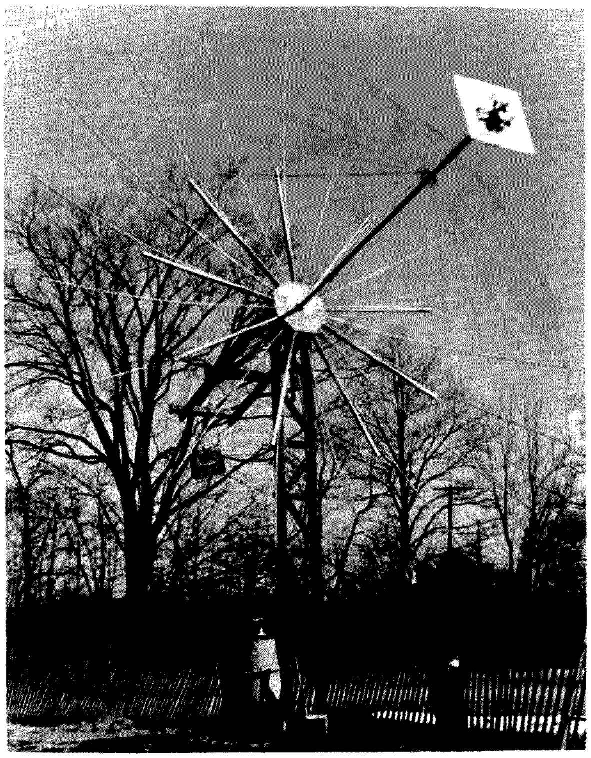
Pack Rat 432 converter;

Drake 2B receiver.

Antenna

20 foot diameter stressed dish on az-el mount – home brew (K2UYH design);

Feed – two sets of dual dipoles over a ground plane, one set horizontally polarized,



The dish.

one set vertically polarized, selectable – home brew, K3BPP. ... W3HMU

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Gee, What's a Zepp?

Practically every time I describe my antenna system during a QSO I get replies like "Gee what's that?" or "Haven't heard of one of those in 20 years." I admit that the center fed Zepp (or multiband antenna) isn't used much these days; however, I think it is ideal for the amateur with limited space and budget.

For the past fifteen years my station has been located in a row house. Those readers familiar with row homes can appreciate my position when I tried to get some kind of radiator into the air. No beams or verticals are allowed; thus, I had only a few alternatives. At first, when I was very young and naive, I tried long wires stretched all over the tiny backyard. One of these gems contained four 90° bends, but I managed to use up 135 feet of wire. This system worked fine on 80 and 40 when connected to my homebrew 75 watt parallel 807 rig. (I considered any contact beyond PA to be DX.) Ten years later I faced a new problem after obtaining some Drake equipment. Being able to work all bands using one antenna and achieving a low vswr had become a real challenge.

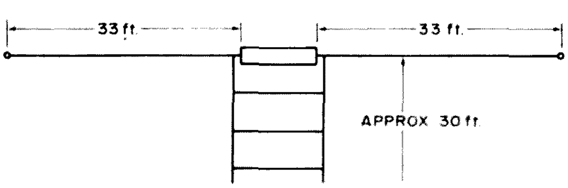

Fig. 1. Basic antenna.

After glancing through the Amateur's Handbook and several magazines, I decided to tear down the old corroded wire and install a Zepp. Following this decision, I carefully handspanned the backyard and the front to back distance of the house. The dimensions seemed appropriate, so I began construction. Two 33 foot lengths of #14 wire and one 30 foot section of inexpensive 450Ω open wire line were cut and soldered together in the usual fashion. One end of the aerial is connected to a clothesline pole extension, and the other end is connected to the edge of the roof towards the front of the house. An off center support is required to prevent chimney contact as shown in Fig. 2. The support is simply an 8 foot piece of 2" x 2" lumber lashed to the chimney. The lead in wire hangs alongside the house and enters the basement via a window. *Voila,* an all band row home antenna is born.

As you may have guessed, this antenna does require an antenna tuner to match the 50Ω unbalanced output of the transmitter to a high impedance "balanced" line. The term balanced is questionable here since the two legs of the antenna definitely are not balanced to ground. But, recall our motto, "never say die." To eliminate some or most of the unbalance problem, a slight change has been made in the conventional coupler circuit which can be any one of the types described in the various handbooks. (A typical circuit is shown in Fig. 3.) C2 is usually a ganged dual section capacitor of 100 to 300 pF per section. I simply used

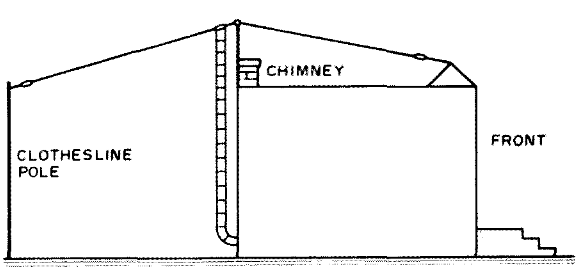

Fig. 2. Side view of row house antenna.

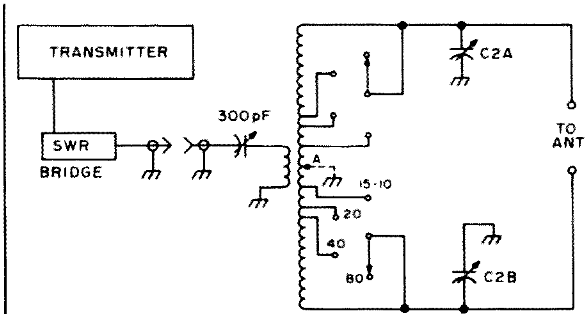

Fig. 3. Typical antenna coupler. A is optional center tap ground which is helpful on some bands. C2 section should be connected in series with antenna for 80 meter operation.

two separate capacitors and tune them individually for minimum vswr and maximum forward power. When properly adjusted, the antenna coupler acts as a very effective low pass filter; consequently, any existing TVI can be reduced considerably.

My antenna loads up well on all bands and radiates a respectable signal with less than 1.5 to 1 vswr. Although the Amateur's Handbook doesn't give this system a real great DX capability rating, I have worked my share on 15 meters.

. . .W3WLX

Caveat Emptor?

from page 16

MANUFACTURERS, Distributors! The Memphis Hamfest will be bigger than ever. The dates are Saturday and Sunday October 4 and 5. Best location possible – State Technical Institute, Interstate 40 at Macon Road. Security. Contact Chairman, Harry Simpson W4SCF, Box 27015, Memphis TN 38127, phone (901) 358-5705.

CALL LETTER LICENSE PLATES – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate – most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

RADIO ARCHIVES, amateur ANECDOTES (then & now) solicited for proposed (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 fourth St. N., Mpls., Mn. 55412.

WANTED – Make, Model and Serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma WA 98466.

SWAN, CushCraft at prices I dare not publish. Call or write WØNGS, Bob Smith Electronics, 1226 9th Avenue North, Fort Dodge IA 50501. (515) 576-3886.

ARIZONA FORT TUTHILL HAMFEST July 25, 26, and 27th. Grand Prize: FT-101B. Flea Market, Contests, south of Flagstaff on Highway I-17 across from airport.

WARREN HAMFEST! Sunday, August 17, Yankee Lake, Ohio. On Rt. 7, five miles north of I80. Dealers' displays. Swimming and picnicing. Giant flea market (Vendor's fee: $1.00 plus registration). A $3.00 registration includes: Door prize, Main prize, and XYL tickets. More info: Hamfest, PO Box 809, Warren OH 44482.

THE 28th ANNUAL Turkey Run Hamfest and VHF Picnic sponsored by the Wabash Valley ARA, Inc., will be held Sunday, July 27, at Turkey Run State Park near Rockville, Indiana. Don't miss the midwest's finest flea market. XYL Bingo, refreshments, camping facilities and park recreation for the kids. Also this year, banquet July 26, 7:30 pm featuring guest speaker W9NTP, in park dining hall. Banquet by reservation only, $6.50/person; reservation deadline July 1. Activities begin 9 am Sunday, talk-in 146.94 W9UUU/9. For details, tickets and banquet reservations SASE WVARA Hamfest, Box 81, Terre Haute IN 47808.

HAMFESTERS 41st Hamfest and Picnic, Sunday August 10, 1975, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OMs and XYLs, famous Swappers Row. Information contact John Raiger K9DRS, 8919 West Golfview Drive, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 South California, Chicago, Illinois 60629.

MEMPHIS is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, on Saturday and Sunday October 4 and 5. Demonstrations, displays, MARS meetings, flea market, XYL entertainment, prizes. Informal dinners Saturday night. Dealers and distributors welcome. Talk-in on 3980, .34-.94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis TN 38127 or telephone (901) 358-5707.

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How Gates Work

A TTL PRIMER

The writing technology of integrated circuits has not kept pace with the design and application technology, as evidenced by the hunger of 73 readers for very basic articles.

It is relatively easy to find circuit designs using ICs and easier still to mimic the projects to a fruitful end although the basic understanding is still lacking.

When writing a book on tube electronics it is simple to know where to begin. It has been standard practice to start with the concept of atomic structure and electron flow off a hot filament. With transistor texts, we begin with atomic structure of semiconductor material and explain the movement of "holes". Digital IC theory does not require us to go microscopic, but it does call on us to think in new ways about electricity, new and unique ways. It is the purpose of this article to start the amateur on this new way of thinking; logically!

Integrated circuits are a complex interconnection of circuit elements within one continuous structure. An IC "chip" may contain the equivalent of fifty transistors and resistors in one package. The TTL ICs discussed in this article are of a digital nature (to be defined later) and so called because each chip can have its function imitated by a myriad of transistor circuitry. In other words, we can do everything a TTL IC can do with transistor-transistor logic circuits, but they will be bulkier, costlier and less efficient.

For the purposes of this discussion let's think of electricity as existing on different levels of value instead of different voltages. For example: We can assign a voltage of 5 volts the value 0, and a voltage of 10, the value of 1. It is customary to give the higher voltage the value of 1 and the lower, 0. If we have a square wave function we can say that the wave fluctuates from a level of 0 to 1 and back. Since the change is almost instantaneous in a wave of this form, the voltage can be thought of as having only two states, 0 and 1. The idea of discrete steps or states is known as digital. The states can be used for yes-no, on-off, or any meaning you may need.

LOGIC GATES: EASY STUFF

The AND Gate

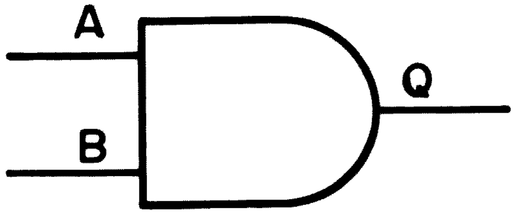

Fig. 1.

Fig. 1 is the symbol for the AND gate. There are two inputs, A and B, and one output, Q. There can be more than two inputs. The concept of AND can be put into everyday terms.

Suppose I said, "I can drive my car only if I have my KEYS *and* GAS." I cannot drive my car if I have only my KEYS or only GAS. I must have both simultaneously. Table 1 is a "Truth Table".

Keys?	Gas?	Drive the Car?
NO	NO	NO
NO	YES	NO
YES	NO	NO
YES	YES	YES

Table 1.

If we let the symbol 0 mean NO and 1 mean YES, we have the following truth table for the AND gate:

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

Table 2. AND gate truth table.

This can be expanded to three inputs by saying that to drive my car I must have KEYS *and* GAS *and* EYEGLASSES. To have two out of three is not sufficient; we must have all three together to obtain an output (drive car).

The NAND Gate

The NAND gate is drawn as shown in Fig. 2.

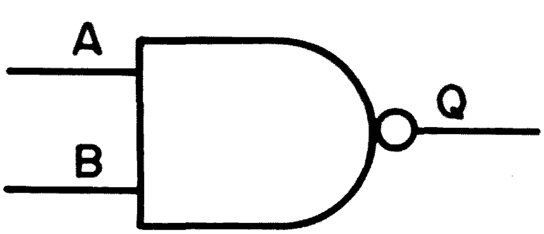

Fig. 2.

The little pimple on the end of the AND gate means "negation". It says, take the AND gate and make a truth table. But, take every answer and negate it. If it comes out 1, make it 0; if it comes out 0, make it 1. That's all.

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

Table 3. NAND gate truth table.

The OR Gate

The OR gate is not used as much as the AND and NAND, but it is important nonetheless. Here is how it looks:

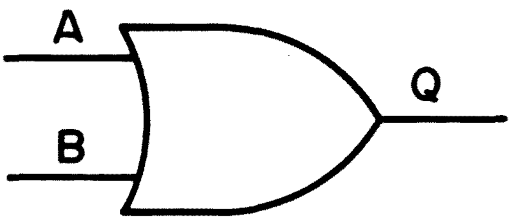

Fig. 3.

An example of its function is to say, "I will have a pleasant day if I GET ON THE AIR or GO MOTORCYCLE RIDING."

Get on Air?	Motorcycle Riding?	Pleasant Day?
NO	NO	NO
NO	YES	YES
YES	NO	YES
YES	YES	YES

Table 4.

As you can see it is not necessary to do both, but at least one. Of course if I do both, I will have a pleasant day, but either is sufficient. The truth table is shown in Table 5.

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

Table 5. OR gate truth table.

The NOR Gate

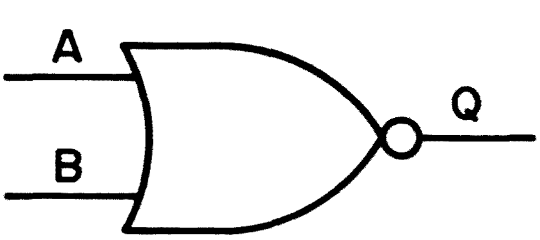

Fig. 4.

As the NAND negates the AND, the NOR is the negation of the OR. Whatever the output of the OR gate, negate it. Table 6 shows a NOR truth table.

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

Table 6. NOR gate truth table.

The last simple gate is the NOT gate. Also known as the INVERTER. Its symbol is:

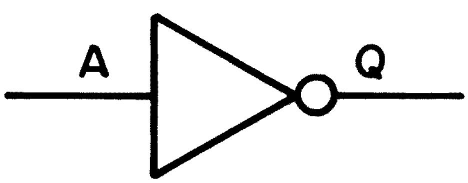

Fig. 5.

Its function is the simplest one of all. It inverts or negates the input. It can have only one input and only one output.

A	Q
0	1
1	0

Table 7. NOT gate truth table.

There are two more gates worth mentioning but they are not considered simple gates like the ones above.

They are the EXCLUSIVE OR gate and the AND OR INVERT gate. The EXCLUSIVE OR gate has a truth table similar to the OR, except that it has no A=1, B=1, Q=1 state. It is exclusive of this logic sequence.

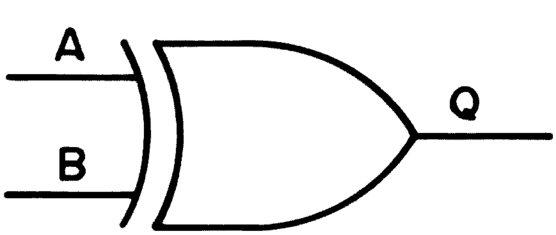

Fig. 6. EXCLUSIVE OR gate.

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

Table 8. EXCLUSIVE OR gate truth table.

The AND OR INVERT gate is a combination of AND and NOR gates and looks like this:

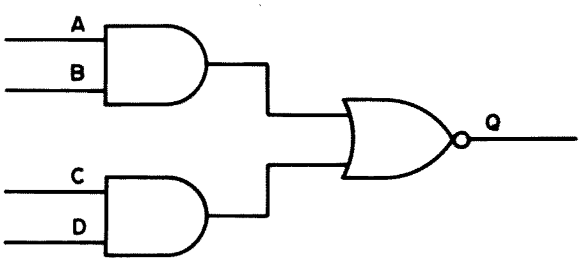

Fig. 7.

To construct a truth table, take each gate individually and follow through to the output. It may be helpful to call the inputs of the NOR gate E and F, and give them each a column until you can do it in your head.

A	B	C	D	Q
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

Table 9. Partial truth table for AND OR INVERT gate.

CLOCK INPUTS: A LITTLE TOUGHER

The square wave previously discussed is very often seen in digital circuitry. It is used in clocks and all types of counters.

If we take an AND gate and impose the square wave (also called a clock input) on input A, we can think of it as going from logic state 0 to 1 to 0 to 1 etc . . . If we then keep input B fixed at logic state 0, the output at Q will be 0. Again look at Table 2. But if we make B=1, then Q will be 0 when A is 0, and 1 when A is 1. We have an unchanged input from Q.

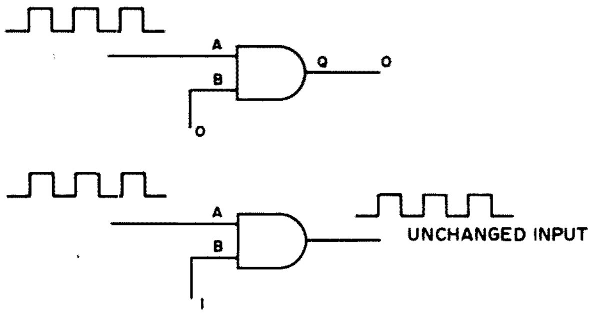

Fig. 8.

The "trick" to doing these is to think of the input as a movement of discrete points and to do the logic for these points. Here is the NAND gate again:

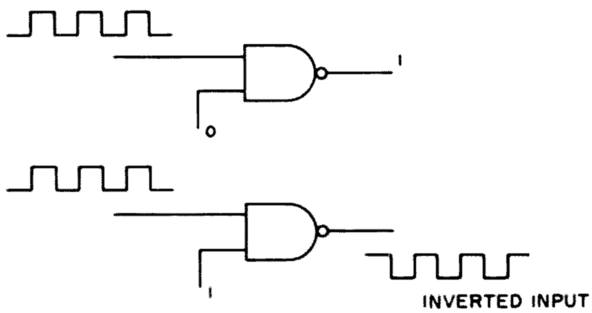

Fig. 9.

The OR and NOR gates follow in like manner:

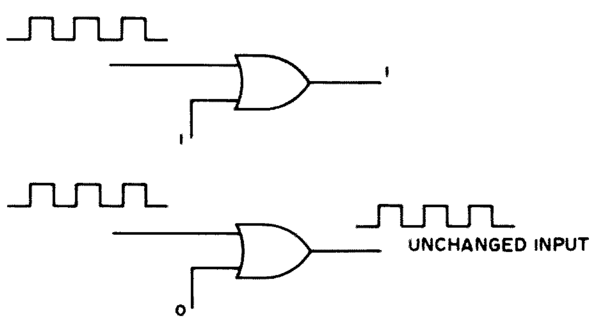

Fig. 10. OR gate.

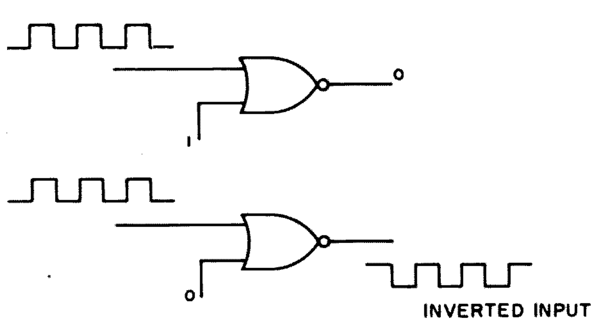

Fig. 11. NOR gate.

GATE TO IC: THE MISSING LINK

If we could look inside the 7400 chip, we would see this:

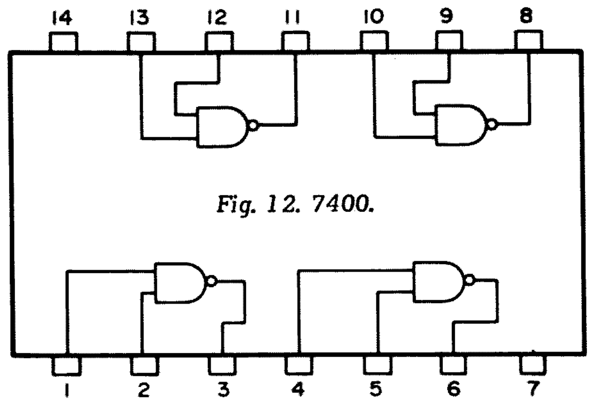

Fig. 12. 7400.

According to the manufacturer it is a Quad, 2 input NAND gate. It has four (quad) gates of which each has 2 inputs, and, they are NAND gates. Pin 7 is ground and 14 is the voltage supply. We can use all or any of the gates. Gates can be connected together if needed for a certain function.

Not all chips can be shown in an "X-rayed" view because some are so complex that drawing is impossible. Such is the case in the 7490 chip which is shown like this:

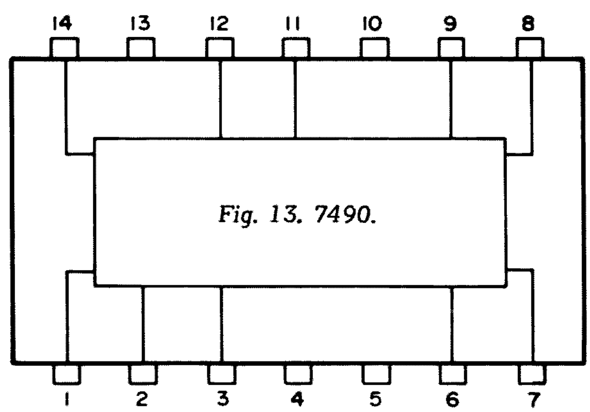

Fig. 13. 7490.

In some schematic IC projects you may also see the chip divided into gates separated from each other. It is easier to break it up than draw the chip in the schematic in one piece. It is also easier to trace the logic with it broken down to gate functions.

Well, believe it or not, that is all there is to digital TTL ICs. That is, the 7400 series. And there are quite a lot of them.

But this isn't all there is to know on ICs. There are non-digital devices, op amps and hybrid or mixture (dig. and lin.) devices, too. If reader response is favorable to this type of a very basic primer on IC technology (not stressing application), the author could be cajoled to do another.

. . . WB2NEL

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Bargain Audio Frequency Source

About a month ago I had occasion to check the frequency response of an audio filter I had built for CW work. Unfortunately, my modest test bench lacked an audio oscillator, and all attempts to beg, borrow, or otherwise finagle one failed. It was at this point I realized I had been unable to complete several projects because I didn't have such an oscillator. Buying one was out of the question; being a college student, my financial status is slightly above that of a medieval serf. I shelved the audio filter and moved on to projects that required simpler equipment, like gas pliers and scissors.

A few weeks ago I walked into the local Radio Shack to pick up my free "battery--of-the-month" (you thought I was kidding about being broke, huh?). On the way out I walked by the record rack and looked over the selections. All of a sudden there it was – a solution to the audio oscillator problem. In the corner of the rack sat Stereo Test Record number 50-1971, which, in addition to many nifty stereo system tests, contained twenty different test tones. It was only $1.49, so I took one home.

Inside of an hour, I had checked out the record on a friend's oscilloscope, which showed that the tones were pretty much sinusoidal. A little work with pen and paper showed that, if played at different speeds, the record could produce seventy-one unique tones. Granted, the record is hardly a replacement for a good oscillator, but it's certainly great in a pinch. In particular, I've used it for checking the approximate bandwidth of phase-locked loops, and it's been a lifesaver.

The following chart lists the frequencies, to the nearest cycle, which can be generated when the record is played on a four-speed turntable:

	SPEED (rpm)			
	33 1/3	16 2/3	45	78*
FREQUENCY (Hz)	30	15	41	70
	70	35	95	164
	100	50	135	235
	200	100	270	470
	300	150	405	704
	400	200	540	939
	440	220	594	1033
	500	250	675	1174
	800	400	1080	1878
	1000	500	1350	2348
	2000	1000	2700	4696
	3000	1500	4050	7043
	4000	2000	5400	9391
	5000	2500	6750	11739
	6000	3000	8100	14087
	7000	3500	9450	16435**
	8000	4000	10800	18782**
	9000	4500	12150	21130**
	10000	5000	13500	23478**
	15000	7500	20250**	35217**

**Actual turntable speed is 78.26 rpm.*
***Beyond the capabilities of most phonographs.*

. . . WA2CXD

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Vertical Antennas for the Novice

The vertical antenna takes up very little space. It is hard to imagine a situation where a vertical could not be installed. It requires no rotator. It can be made of cheap material – just wire and insulators, or metal tubing. It is easy to tune, has no icing problem, and is great for working mobiles. I have repeatedly tested it on 40 against an inverted V, and find I can work mobiles all the way in from Columbus, Ohio, about 40 miles away, but on the inverted V the best I can do is ten miles. This is, of course, the result of cross polarization. The antennas on mobiles are verticals, also.

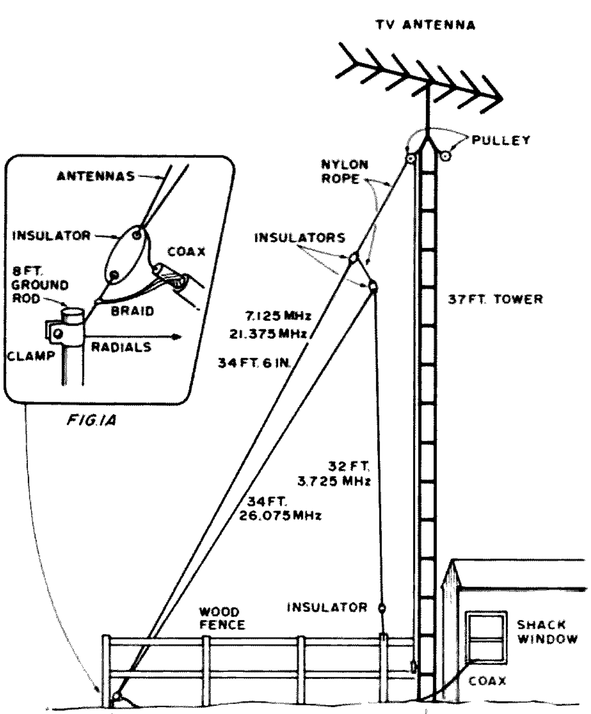

Fig. 1.

In the past ten years at this address, I have tested at least thirty antennas, from 40 meter beams to 2 meter ground planes, but there is one pair of antennas that I always keep up, and that is the one shown in Fig. 1. There is nothing quite as handy for antenna experimenting as a pair of good pulleys on the top of a TV tower. You can let the rope down, ¼" nylon, and tune or change your antenna in a few minutes. I have another TV antenna at the other end of the house, also with a pair of pulleys. Before I got the pulleys put up I used a hobby type bow and arrow to shoot my rope through my tower to pull up the antennas.

The two antennas in Fig. 1 are ground

mounted "almost" verticals. By placing them 22' from the tower, I could get a longer radiator, and have the base at the wooden fence, where I could run a couple of tuned radials along the fence.

The 7 MHz antenna can be used on 21 MHz band, and the 3.7 MHz antenna can be used on 28 MHz. A 68 ft. radial runs in each direction at the base. The radials are not buried. They are insulated except where they connect to the ground rod. The ends are well taped because on 3.7 MHz the ends are hot. The coax runs from the bottom end of the two antennas on or in the ground into the shack and is 45'5" long. This is a full wave at 7.125 MHz times .66 velocity factor for the coax. It is about a foot too long for ¼ wave on 3.7 MHz.

The reason I show this antenna is to give you an idea how far you can go in designing antennas away from the general idea of verticals, and yet have a cheap, effective, easily erected 4 band antenna.

The base of the usual vertical antenna is about 36 Ohms impedance, and the coax is 50 Ohms. This gives an swr of about 1.4. If you are using an swr bridge, don't make the mistake of cutting the antenna to 1.1. Leave it at 1.4.

If you use an swr bridge, it must be either at the antenna, or at a multiple of a half wave away from the antenna. I once worked a ship in the harbor at Valparaiso, Chile, where the radio man had just spent two days with a hack saw taking an inch at a time off a 26" vertical pipe antenna, and got it down to 1:1 swr on 40 meters when the pipe was about 8' long. He wondered why. I found out that he had put the bridge at the transmitter and had no idea how long the coax was. He asked what to do. Of course I told him to get another pipe and start over, and put the bridge at the antenna. I told him to start with 32'.

If you cannot afford an swr bridge, Fig. 4 shows a way to get along without one, for

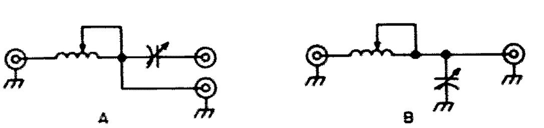

Fig. 2.

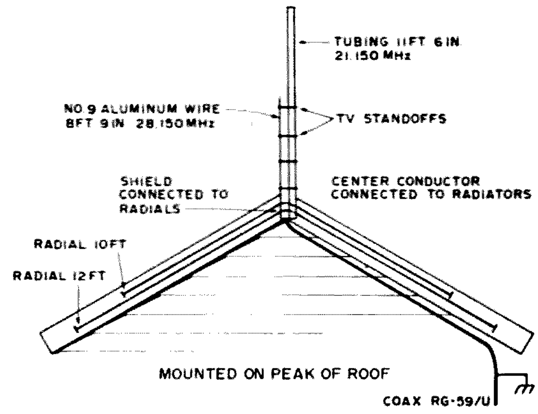

Fig. 3.

many purposes. For a 72 Ohm antenna, such as a dipole, you connect the transmitter to A, and tune the transmitter to the proper loading on the plate meter. Then throw the switch to B, and tune until you get the same output on the plate meter. If you have a 52 Ohm antenna, then use a 52 Ohm resistor. You should use non-inductive resistors, and most hams use parallel 2 Watt carbon resistors; for example you can use 20 1000 Ohm 2 Watt resistors in parallel, and get 50 Ohms at 40 Watts, which is enough for a fast tune up of a Novice transmitter. You can use 1500 Ohm resistors for approximately 72 Ohms.

Fig. 2(a) shows how to make a random wire tuner, using a length of Air Dux coil and a well spaced 100 pF capacitor, or a line flattener as in 2(b) for use with most coax fed antennas. It will work best one way, and you may have to turn it end for end to get the best results. The capacitor can be a receiving type variable capacitor, of about 365 pF capacity.

Fig. 5 shows one of the favorite verticals, which can be made as follows: Hammer into the ground a 4' length of 1¼ inch galvanized water pipe until about 12" is left sticking out. Then take two telescoping 10' lengths of anodized TV masting, and slip them together. Drill two small holes opposite each other and hold them together with metal screws. Then slip a 12" length of plastic tubing over the bottom of the 1¼ masting, and fasten with 2 U-bolts. The U-bolts may slip in a high wind, so you can use either the method of 5(a), which is a split section of 1¼" water pipe, with the halves welded together back to back, or guy the antenna

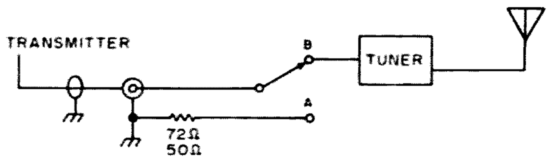

Fig. 4.

with a guy ring as in 5(b). For this you use a TV guy ring with three screw eyes, and 1/8" nylon or plastic line.

If you only want to work 15 meters, the masting can be 11'6" high, and for ten meters 8'9" high. The coax shield is attached to the support rod, and should have an eight foot ground rod. No coil will be needed for either of the last two, 15 or 10 meters.

For 15 meters and 10 meters there is a better way, which is shown in Fig. 3. Use a house peak mount, with a tubing 11'6" long, and then with TV standoff insulators run a piece of #9 clothes line aluminum wire up 8'9", with the lower end attached to the base of the tubing. Then from this same base run two radials stapled to the facing on the house with one being about 12' long and the other about 10' long with the ends taped or with a piece of plastic tubing slipped over the ends. Ground the shield of the coax in as direct line as possible to an earth ground or water pipe. This little antenna will work the world when the propagation is right.

I am purposely not telling you about $50 commercial antennas, or anything that costs a lot of money. When you are a Novice you want to get on the air as easily as possible and work stations so you can get your speed up and go to a higher license.

If I were to want a real simple antenna of high quality which my wife would never object to, I would make one change in Fig. 5. I actually have the tubing, but have not yet put it up. It is a ten foot length of 1½" thick walled (1/8") aluminum, with a ten foot length of 1¼" aluminum tubing slipped inside it. The bottom is slipped inside a foot of 1½" plastic tube, and the plastic set in a 2'x2'x3' block of concrete, with the bottom of the plastic sealed shut to insulate the pipe from ground. Then I would take two TV standoff insulators with the rods unscrewed, and strap them to the 1½" tubing, and using the screw holes, would bolt a plastic box to the two standoffs. Then put a length of Air Dux coil in the box, and a 100 pF wide spaced capacitor in the box as per 5(d). Run one or two insulated wires 34 feet long as radials with the ends taped, either through shrubbery, or along the house, or along a fence, in random directions. Then I would put a wooden ball with a 1¼" hole in it on top of the tubing. I would paint the ball or spray it dark green so it would not show against the trees and grass. Then I would have an antenna which would work 40, 15 or 10 meters with excellent results, and I could even put a pulley in the ball, and a nylon loop so a flag could be raised on it. No guying would be necessary and a small shrub at the base could hide the tuner. The voltage at the base is very low, and shrubbery or long grass or even deep snow has little or no effect. A stepladder will be enough to raise you so you can take down the top section and put it back. Put a collar on the top section so it won't slip down inside, and seal the joints with tape or spray so that no water can run down inside and freeze. Or you can run the top inside the bottom section about 6" and drill a hole and bolt the two sections together, and then tape over the bolts.

By using an swr bridge you can get someone to help you dip it, or take the bridge out with you and dip it at the antenna. Short out turns until the capacity dips at about mid-scale.

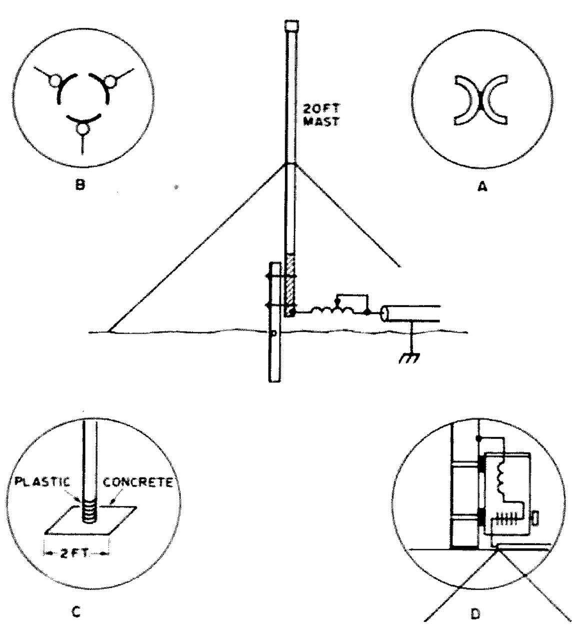

Fig. 5.

If you will only work 15 meters and 10 meters, with this antenna you can forget the coil and capacitor and connect the coax center to the base of the antenna. Then slide the top section down until the overall length is 11' which will put it on 15 meters, 21.150 MHz, and then use the tuner in 2(b) to tune it for 10 meters. When you get your General license you can run it back up to 16' and use it on 20 meters.

That way nothing is wasted, and with an inverted V antenna for 80 meters you may never want another antenna. There are people who will tell you that a vertical needs a hundred radials, just as there are people who will tell you that you need a linear. I worked phased verticals for phone patch traffic for ten years with Antarctica with a single eight foot ground rod at the base of each antenna, and a single tuned radial running along my fence from the base of each antenna. I put one of the most consistent S9 plus signals into all the Antarctic stations for ten years on 40 meters during the winter down there. The beams beat me out on 20 meters but not on 40. . . . W8HXR

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Do Textbooks PREVENT Learning?

Tom Swift and his electric science fair project

Tom walked down the street humming a happy tune to himself. He had built an electromagnet with his own hands and was going to test it out as soon as he got home. The test was simply to determine how many paper clips it could pick up.

At home, he gathered a handful of paper clips, a D cell from his flashlight, and his homemade electromagnet (Fig. 1). Holding the leads from the electromagnet to the top and bottom of the flashlight cell, he picked up a bunch of paper clips. He released one lead and all the clips dropped to the table. "Seven clips," he counted. This was less than he had hoped for, but better than nothing. The hour was getting late so Tom put away his materials in a cardboard shoebox, and went to bed.

The next evening Tom visited his Uncle Boll to discuss how to lift more paper clips with his electromagnet.

"We decided that it should lift at least 12 paper clips, but it won't lift more than 7," Tom told his uncle.

"How would you increase the pull?" asked Boll.

"Well, how about 2 cells?" said Tom.

Boll said "Go ahead and try it." So Tom did, and sure enough, he did pick up a nice size clump of paper clips. At the same time, the wire began to get warm – always a warning signal.

"That's the brute force method," said Boll. "It works, but there are better ways. Let's add a heelpiece."

"What the heck is that?" asked Tom.

"Here is an example," said Boll as he handed Tom an angle bracket. "Put it on like this." He connected the bracket so the end was flush with the screw head, as in Fig. 2.

"Now how many paper clips can you pick up?"

Tom tried it again and came up with a good bunch of clips sticking to the head of the bolt and the end of the bracket. He released the wires and they all fell to the table.

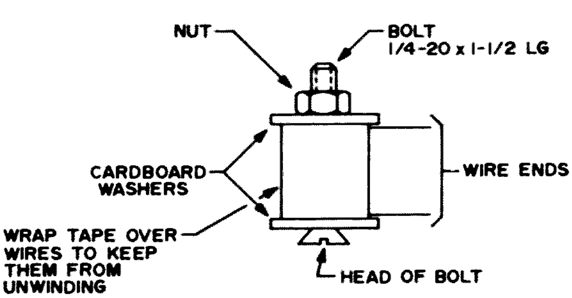

Fig. 1. Tom's electromagnet.

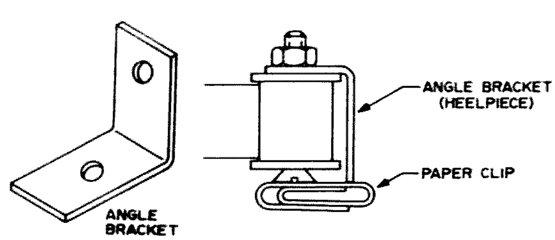

Fig. 2. Angle bracket added to electromagnet for more "pull."

"Seventeen! Hey, that's a real improvement. How come it works that way, Uncle Boll?"

"Well, the theory is a little complicated but I'll give you a simplified explanation. When you had the bolt without the angle bracket, the magnetic field was like this. (Fig. 3) Current in the coil makes the bolt act as a magnet, but most of the magnetic path is through the air, and air is an insulator for magnetism."

"So the result is a weak magnetic effect?" asked Tom.

"Exactly. But watch what happens with the heelpiece added.

"Most of the magnetic path is through the iron bolt and bracket and only a short path is through the air. And when there are paper clips in the air gap, they have the effect of providing a better magnetic path."

"Wait a minute!" Tom said. "You told me once you can't get something for nothing, but this sure looks like it. Where does the extra pull come from?"

"Good question, Tom. If your coil was wound on a solid ring of iron, you would have zero air gap and a very strong magnetic field. It would be hard to measure with simple equipment. Someday we'll look into it. But suppose we cut a tiny slot in the ring. When we cause current to flow in the coil, what will happen?" (Fig. 5.)

"Would it pick up a lot of paper clips?" asked Tom.

"No, hardly any at all," replied Boll. "Guess again. Too bad we don't actually have one to try, but here's what will happen.

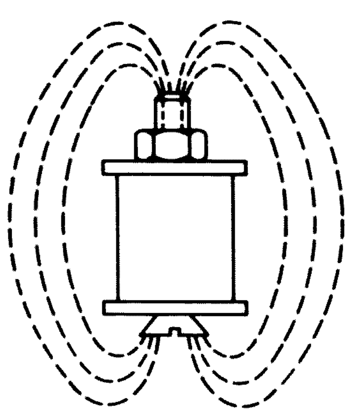

Fig. 3. Lines showing magnetic path through the air.

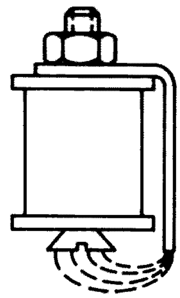

Fig. 4. Lines after heelpiece is added.

When current flows through the coil, the gap in the ring will close up."

"Gee, it seems like the magnetic force must be very strong to do that."

"Sure," answered Boll. "Anyway, the crude electromagnets we are building are far less efficient than the ring and we are getting far less out of the design than we might. We are just making a small improvement but you see we are not getting something for nothing."

"What about that sketch in my science book," said Tom, "where there is a spike and some turns of wire and a dry cell? That's pretty inefficient."

"Well, Tom, that's a good example of a brute force approach that is totally impractical."

"But why is it in the textbook then?" asked Tom.

"Look at the title page of your book. Notice that the authors are all educators. Not one of them is an engineer or knows anything practical about building devices that must work. That's why that sketch is there. Since most of these sketches were copied from earlier books, most of your science books have the same unworkable projects in them.

"But that's enough for tonight, Tom. Tomorrow is another day."

So Tom went home, with his latest model in his pocket.

At school the next day, Tom talked to his friends who were also using electromagnets in their science projects. One boy was duplicating the electromagnet in the textbook; the other boy was using a similar electromagnet but he had obtained a power supply to eliminate need for the dry cells. Unfortunately, his wire coil got very hot and

he could not keep it turned on continuously.

"The brute force approach again," Tom said to himself.

A week went by before Tom spoke to his uncle again. They discussed the other boys' projects and Boll said, "Why don't you help them improve their projects?"

"Are you kidding?" said Tom. "That would be helping *them* to win, but *I* want to win!"

"Why is that?" asked Boll.

"Well, the rules say that there will be only one winner picked in the electromagnetism category."

"But if you helped those boys improve their projects, wouldn't they learn more as a result?" asked Boll.

"Sure, but what has that got to do with it?" Tom asked.

"Aren't science fairs supposed to be educational?" prodded Boll.

"Yeah," said Tom, puzzled. "I don't get you, Uncle Boll. What do you mean?"

"Simply this," his uncle answered. "As you can see, the rules are set up to *prevent* learning, not encourage it. But those are *their* rules. If you believe in the value of learning, and helping others, follow your own rules. The penalty to you is to reduce your chance of winning. There are other ways to operate, such that everybody wins and nobody loses. But that is not the science fair as we know it."

This was a startling idea to Tom and he said nothing while he was thinking about it. His uncle interrupted his thoughts.

"Let's work on your project. What can we do with the electromagnet?"

"We can demonstrate how a relay operates. But we'll need a moving part," said Tom.

"Armature is the proper word," his uncle corrected.

"A hinge would make a good armature, but we need a way to hold it in the right position."

Boll handed Tom a box of angle brackets and other parts. "Try these," he suggested. After some experimenting Tom ended up with the apparatus sketched here as Fig. 6.

When Tom connected the dry cell to the coil, the armature banged in with a satisfying clank. When he interrupted the current, the spring pulled the armature back against the backstop.

Tom also noticed that if the backstop was too far back, the electromagnet could not attract the armature. The bolt that held the spring was put in after experimenting to determine the best position.

Tom took this "thing" home. It needed a name and he decided to call it a tester. The reason he picked this name was that he could try out different electromagnets and see which ones worked best. He showed his mother and dad the tester and they were very pleased.

"So that's what you've been doing at Bolivar's house all this time," his dad said.

"I hope you haven't neglected your homework," was his mother's comment. His folks didn't see too much value to this tester but at least it was constructive activity for their son.

When Tom got home from school the next afternoon, there was a note for him.

"Call your uncle tonite after 6:00." His uncle hated to be interrupted with phone calls during the dinner hour.

At 6:01 sharp, Tom called. "What's up, Uncle Boll?"

"We have to get started on production," his uncle said. "When can you come over?"

Tom had loads of homework that night and his understanding with his parents and uncle was that homework had priority over other activities.

"How about Saturday?" Tom asked.

"Saturday it is," his uncle replied. "Ten o'clock." And he marked it on his calendar, next to the telephone.

Saturday morning Tom was at his uncle's house with his electromagnet and his tester.

"What are we going to do today, Uncle Bolivar?"

With a chuckle his uncle replied, "We are

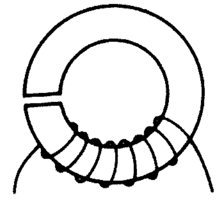

Fig. 5. Coil wound around a slotted ring.

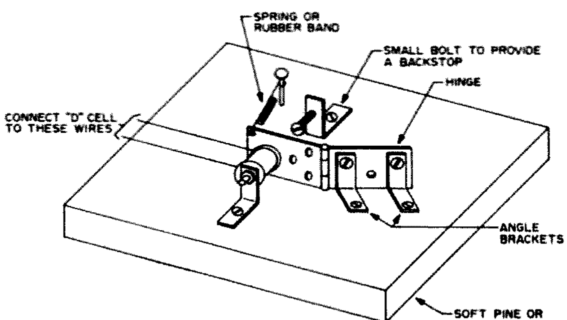

Fig. 6. Tom's "tester."

making a gift for your science teacher."

"Like what?" Tom asked.

"Like 60 electromagnet kits for her next semester classes to use when they study electricity," he replied. "Here are the materials we need."

There on the table was a box of bolts, another box of angle brackets, a large spool of wire, a bundle of small paper bags, and some other materials.

"We will start with winding the wire on something. We'll use about 80 to 100 feet of wire," said Boll.

"Why don't we wind it on the bolt?" said Tom.

"Nope, you miss the whole point," replied Boll. "This kit is designed to be educational. If we wanted to make it *easy* we could build the entire electromagnet, but then it would have less value for learning. Let the students wind the wire on the bolt themselves. We will use these little cardboard tubes to wind the wire on."

Under his uncle's direction, Tom set up a small electric drill, holding it in the bench vise. He plugged the cord of the speed control into an adjustable timer.

By experimenting with the timer and speed setting of the drill, Tom was able to wind about 90 feet of wire on a cardboard tube in about 30 seconds. He guided the wire back and forth as it wound up so that it was fairly even. The arrangement looked like the sketch of Fig. 7. The timer shut off automatically in 30 seconds, making Tom's task very simple.

"Say, this is fun," said Tom, as the small pile of wire-wound cardboard tubes was increasing. But by the time he got to the last of the 60, he was saying, "I'm sure glad I don't have to do this every day."

"Is this how they wind coils for relays and stuff in factories?" Tom asked his uncle.

"Well, the idea is the same, but the actual equipment is different and runs much faster. Also, they will count the actual number of turns of wire, where we just want a rough figure on the amount of wire. But if you understand this, you would have no trouble in understanding a modern coil-winding machine."

"Gee that's simple," said Tom. "I always thought machines in factories were complicated and mysterious."

"If that was true," his uncle said, "how would ordinary people be able to use them – or invent them?"

The next step was making the cardboard washers that held the ends of the coil on the bolt. Tom used a paper punch to make the holes, and a small cardboard fixture to hold each cardboard disc in the same position so that the holes were always in the center. His hands were sore from squeezing the punch by the time he had made 120 washers, and he was glad when lunchtime came.

After lunch, parts were placed into the bags so that they had 60 complete kits. Tom made up five extra kits for his own use later on. The box of electromagnet kits was too heavy to carry home so Tom left them at his uncle's house.

Tom had decided to help the other boys who were entering electromagnets in the science fair. He showed them his tester and explained some of the things his uncle had showed him. The boys were both pleased that Tom had taken the trouble to help them, but also puzzled that he would reduce his own chances of winning.

Tom showed the students in Mrs. Smith's science class how his tester worked. Most of them found it very interesting. Mrs. Smith asked Tom if she could take it home over the weekend. Tom readily agreed.

When she brought it back on Monday, she was bubbling with enthusiasm over how it

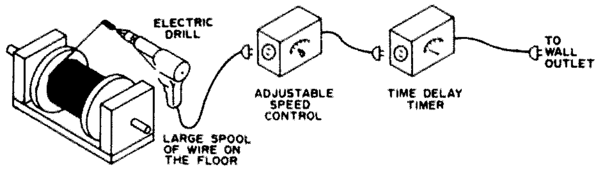

Fig. 7. Uncle Bolivar's coil winding equipment.

was a great teaching aid. She even wished aloud that she had enough for the whole class to use. Tom had not mentioned the 60 kits and he kept quiet now. But he thought to himself how his school had had science fairs for the last ten years, with hundreds of students working on hundreds of projects and not one of them ever resulting in any equipment that the teachers or students could use in class. He intended to change that pattern at this year's school science fair. In discussions with his uncle he had decided on a title for his project:

DESIGN OF AN ELECTROMAGNET
FOR CLASSROOM USE

His poster showed the simple calculations he had made in calculating wire length, how the value of current was selected, etc. An assembled kit was fastened to the poster, and another kit, with parts spread out and labeled, was also included. The tester and some graphs were also part of the exhibit. These were graphs Tom had made from measurements of pull as it was affected by the air gap spacing between the armature and the core (bolt head). Another was a graph of pull as affected by the amount of current in the coil. Tom made all the measurements himself, but he borrowed instruments from his uncle as he needed them.

On the day of the science fair, Tom was up early in the morning. He carefully loaded all his materials into the family car. At ten o'clock he had his dad drive him to school so he could set up his project. There were many students there already, with lots of milling around, noise and last minute crises. As Tom was setting up his equipment, Mrs. Smith walked by.

"Who do you think will win in your category?" she asked Tom.

"You will," Tom replied, and quickly walked away before she could ask any questions.

Later that morning, two judges came by and interviewed Tom. They were quite impressed with his exhibit and with his knowledge of what he built and how it functioned. In fact, they were agreed to give him a rating of outstanding in his category when one of the judges asked Tom why he decided to work out the design of the electromagnet, and why did he say, "FOR CLASSROOM USE." So Tom explained about the 60 kits he had built which he was going to give to Mrs. Smith.

At this the judges were first very surprised and then very intrigued. There was a hurried conference that Tom couldn't hear, and then the judges came back. They asked Tom if they could assist in presenting the kits. Tom readily agreed because he was not too sure how he was going to handle it anyway. The judges left, smiling and talking excitedly to each other.

About an hour later, the school principal was reading off the names of all the winners. As you might have guessed, Tom did win in his category. But then a gentleman in a brown suit stepped to the microphone. Tom recognized him as the older of the two men who had judged his exhibit.

"I would like to announce a very special award to Mrs. Mary Smith who teaches science here." And he was holding a large, heavy box, wrapped in tissue, and tied with a shiny white ribbon. Mrs. Smith was completely surprised and flustered as she walked up to the microphone, and Tom chuckled to himself as he recognized that inside the gift wrapping was his box of kits.

Mary was puzzled as she opened the box, and took out a bag, and opened it. When she peeked inside, all of a sudden she smiled, looked around and caught Tom's eye and winked. Tom thought he saw a tear in that wink. Then the man at the microphone was saying, " . . . and this young man, who saw a need and took it upon himself to constructively meet that need, is truly a credit to your school and your community."

When Tom found himself up front shaking hands with the judges and the principal and Mrs. Smith, there was a tear in his eye, too. Way back at the edge of the crowd he caught sight of his mother, dad and Uncle Bolivar beaming at him.

Later, as they went home, his uncle said to him, "Well, Tommy, we beat their system. We beat 'em at their own game and we did it without tearing anything down. How about that!"

And Tom thought that was really great.

. . . MOCKING

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CANADA

A Visit to the CB Store

I normally don't like to knock the other services but I just couldn't resist writing about my recent visit to a CB store. I was just walking past the place and thought I would go in and see what's new on the other side of the fence. I stopped at the door and looked up and down the street to make sure nobody would see me entering this type of establishment. I didn't recognize anyone on the street so in I went.

The fellow at the counter was very busy demonstrating a new piece of gear. It was an AM/FM broadcast receiver, automatic alarm clock with digital readout, a 23-channel CB transceiver and several other things but I forget what these were. The best part of this rig, however, was its price tag, only $499 for a full 5W. I just kept listening to the man behind the counter trying to sell this fantastic electronic device. He was now pointing out a real handy feature. Inside the covers on this little rig was a small adjusting screw which you could turn to get anywhere from zero to better than 100% modulation. At this point I did a very ignorant thing. I asked him how you could obtain better than 100% modulation. Would that not be overmodulation? The man was very kind and patient, he explained that you can run with better than 100% modulation as long as you don't have any distortion. It seems it's the distortion that gets you in trouble not the overmodulation. "Hmmm," says I, "is that how it works?"

Still keeping an eye on the window to make sure nobody would recognize me, I spotted a device that looked like one of the gadgets that hams use. It was called an antenna matching unit. It consisted of two variable capacitors and one coil mounted in a mini box about 4cm (1½") square. The price was $15.95, and there was just nothing that it couldn't match. No wonder these fellows don't build their own antenna tuners when there are fantastic bargains like this available. Another thing I noticed was a counter full of wattmeters that read from 0–200W. Now I wonder what a CB operator would use one of these for since the scale was graduated in 5W divisions. A lot of the beams and quads were rated at 1 kW. This seems to be an unnecessary expense for people who never run over 5W. Oh well, I guess they want to have a good safety factor.

This store really had everything: Ham M rotators, antennas of every size and shape and hundreds of microphones and speech compressors. I was told that a speech compressor is the living end. If you had a speech compressor, well, there would be no limit to what you could work because these devices double your output to 10W. Some of the new rigs even have them built in. I asked about SSB. He said SSB has two big advantages. It gives you 46 channels instead of 23. You can work more DX with it because it increases your power output. It does, however, have several disadvantages. It is very expensive, only hams can afford it. It sounds funny, and if something ever goes wrong you are really in trouble. It seems there are not too many people around who can fix SSB, especially if it is solid state. The only way to get them fixed is to have them replaced by the importer. Maybe some of us hams should start up a CB repair business. The CBers generally seemed to agree that SSB is the only way to go. Some of them even feel that AM should be outlawed (sound familiar?).

In another corner of the store they had VHF receivers. You wouldn't believe how many different types. If you have one of these in your car, you can get to the scene of an accident or crime before the police. You can get to the scene really fast because they also sell flashing red lights to put on the top of your car. These make you look like a police car. If you want to go all the way you can purchase a big sign to go on your trunk that says, "This is an Emergency Vehicle." Oh, well, I better get out and do the rest of my shopping . . . 10-4.

. . .VE3FEZ

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Preventing Regulator Carnage

Monolithic IC regulators such as the LM309 et al are here to stay, as are the newer, more sophisticated dual tracking voltage regulators like Raytheon's 4194. They include a number of fail-safe features – most notably, short-proof circuitry and thermal overload shutdown; but in many cases, that's not enough protection. Presented here are some other possible failure modes, and how to avoid them.

Reverse Bias Across the Regulator

This accounts for a number of otherwise unexplainable regulator failures. To see why this problem occurs, examine the typical 3 terminal regulator supply in Fig. 1(a). If the input capacitor should go rapidly to ground (through a short, for example) the output becomes more positive than the input, setting up a reverse bias across the regulator's series pass transistor which can destroy it. Adding a diode in series with the dc input, as shown in Fig. 1(b), can eliminate the problem; but the diode does add a series resistance and consequent voltage drop. Fig. 1(c) shows a better way. The 1N4001 is normally biased off because V*in* is greater than V*out*; but should V*out* become more positive, the diode conducts, dumping the current back to the input without going through the regulator itself.

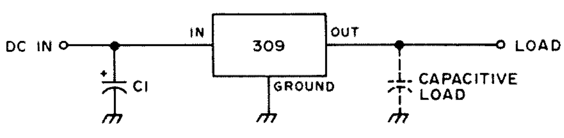


Fig. 1(a).

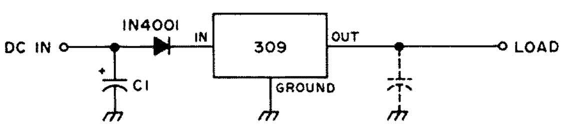


Fig. 1(b).

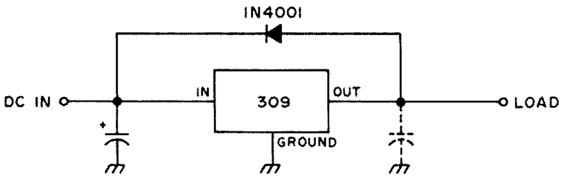


Fig. 1(c).

Improper Polarity Transients at the Output

If a large negative transient hits the output of a positive regulator, or if a positive transient hits the output of a negative regulator, all kinds of troubles can occur. Unfortunately, transients riding the power supply line can be a fairly common occurrence; once again, a diode solves the problem.

Fig. 2 shows a simplified diagram of a typical dual tracking regulator. By connecting two diodes as shown, opposite polarity transients can do no damage. Any positive transients on the negative line shunt to ground through diode D1; D2 performs a similar function for negative transients.

Excessive Input Voltage to the Regulator

The popular LM309 and several similar regulators are rated at a maximum 35 volt input, and that's for real. Anything over 35 volts can easily zap the regulator. Even if you're running around, say, 33 volts, a good

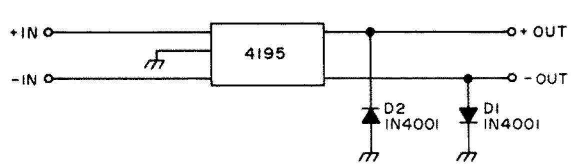


Fig. 2.

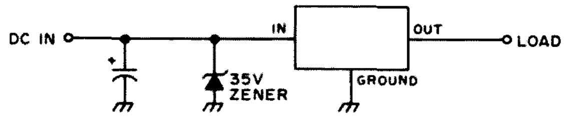


Fig. 3.

voltage spike or upward change in the line voltage can cause the 35 volt figure to be exceeded. The best way to deal with this is to use a 35 volt zener across the input of the regulator, catching any possible overvoltage problems (see Fig. 3).

Excessive Voltage at the Regulator Output

This can happen in a couple of ways. The first is human error: Test probes slip, a loose lead will brush up against an output terminal. Additionally, in some regulator systems external output transistors are used in conjunction with a low power regulator (like the 723) to give higher output currents. When these external devices fail (and they sometimes do, unless you're using one of National's LM395 blow-out proof transistors), the chances are excellent that they will fail as a short, rather than open, circuit. So what happens? Look at Fig. 4(a). The *full* voltage at the input of the regulator is now present at the output . . . not a healthy set of circumstances. The simplest way to deal with this problem is a zener dioded across the output of the regulator, as in Fig. 4(b). Any excess voltage will shunt to ground.

A somewhat more thorough method of resolving this problem is with an SCR-resistor-zener diode "crowbar" circuit, applied to a simplified 15 volt supply in Fig. 4(c). As long as the output voltage remains at 15 volts, the SCR does not have sufficient gate current to trigger, and represents an "off" or high resistance state. But if the voltage on the output of the supply goes higher than 15 volts, the voltage differential between the gate and anode of the SCR — hence the current injected into the gate terminal — suffices to turn the SCR on, causing a virtual dead short to ground and shunting any high voltage safely away from the circuitry. Choose an appropriate zener for different power supplies; it should be the same as the desired output voltage.

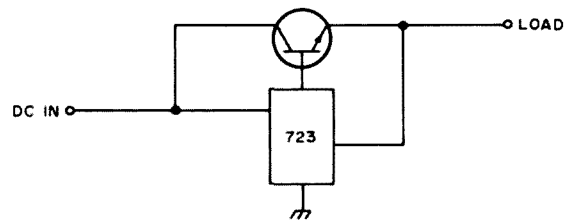


Fig. 4(a).

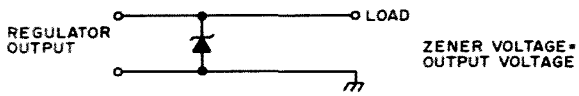


Fig. 4(b).

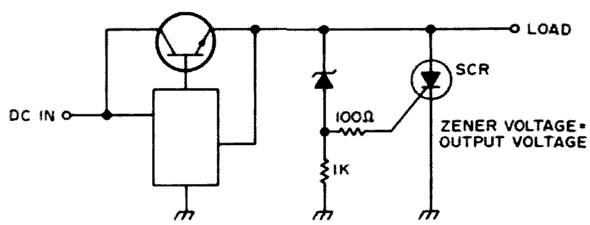


Fig. 4(c).

Protecting Circuits from Power Supply Reversal

Although not a modification made to the power supply, this still falls under the heading of protection. As you may have already found out on the bench, reversing the voltage going to an IC can instantly destroy it. Simply placing two diodes in series with the op amp supply leads shown in Fig. 5(a) guarantees that even if you reverse the supply lines, the op amp will be safe from harm.

If you have a lot of ICs on a board, however, adding two diodes for each one can

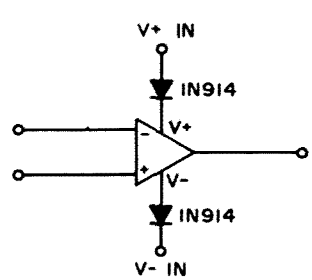


Fig. 5(a).

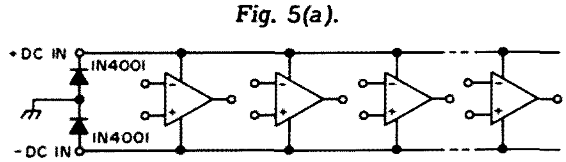


Fig. 5(b).

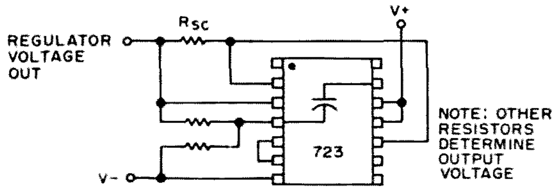


Fig. 6.

be a bit of a chore. In this case, try two diodes as in Fig. 5(b). Should the power supply lines to the board reverse, the diodes shunt improper polarity voltages to ground.

Protecting the 723 from Excess Current

The 723, one of the most common regulator ICs, has a built-in current limit feature. Looking at Fig. 6, you'll notice that R_{SC} is the current limiting resistor. You can derive its value from the formula $R_{SC} \cong$ .7/max allowable current (for example, to limit current to 50 mA, R_{SC} = .7/.05 or 14 Ohms). This feature not only protects the regulator, but the circuit under power.

Protecting Circuits from Excess Current

It is possible to limit current with a power transistor-zener diode arrangement

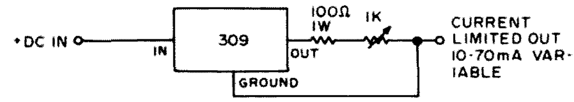


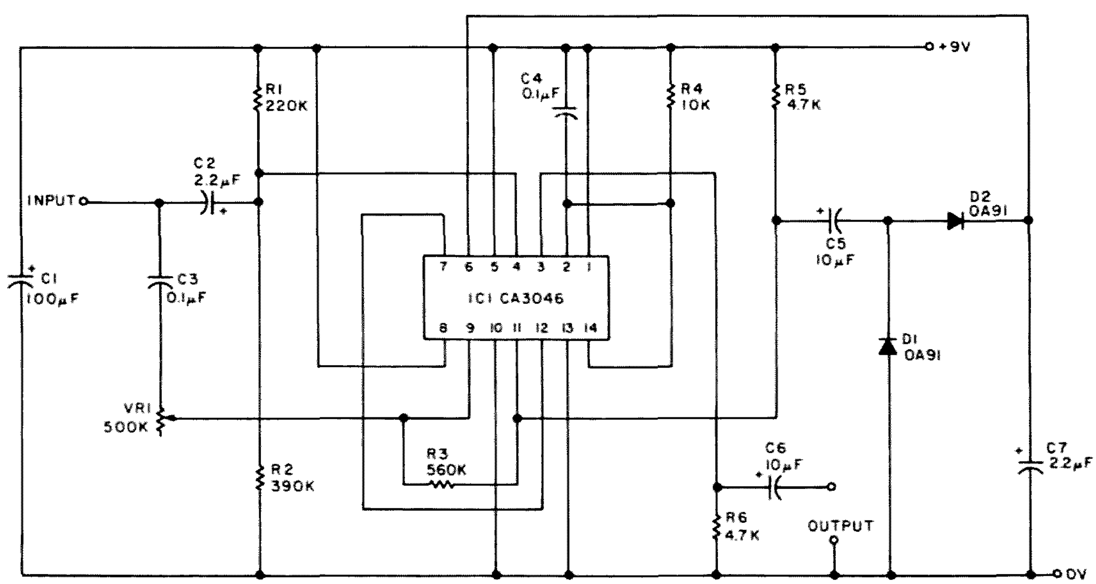
Fig. 7.

for power supplies that don't have current limiting; an approach that involves a smaller parts count uses the current limiting properties of the LM309. When hooked up as in Fig. 7, resistor R sets the current limit point. A good 309 will limit down to about 10 mA. Remember, though, that you are dissipating a certain amount of power through R, particularly at high current values ($P = I^2R$), so choose an appropriate wattage. The circuit shown limits from 10 to about 70 mA, a good range for experimental breadboarding.

There you have it, seven ways to help protect your circuits and power supplies. If you use these various protective techniques, you'll find that the number of "mysterious" failures will go down, and that you will feel more secure about using the equipment you've made.

. . .ANDERTON

CIRCUITS, CIRCUITS, CIRCUITS. . .



Audio squelch unit. Complete project is in Sept. 74 issue of Radio & Electronics Constructor, 57 Maiden Vale, London W91SN, England. Subs $7 per year.

73 MAGAZINE STAFF

The Ultimate in Variable Selectivity?

Many amateurs would undoubtedly love to have available on their receivers or transceivers a *continuously* variable i-f selectivity control that allowed the selection of i-f bandwidths suitable for CW reception under extreme QRM conditions to the selection of i-f bandwidths suitable for normal SSB reception. Such continuously variable i-f bandwidth and bandpass tuning controls have been present on various commercial grade receivers in the $1,000+ category for several years and usually involved the use of a tailored multiple-gang air variable capacitor (up to six sections) of special design and very critical inductor elements. The direct adaptation of such designs to amateur equipment is certainly not practicable. However, the introduction and wide availability of capacitance variable varactor diodes at low prices (less than $1.00 each for the Motorola MV series) provides radio amateurs with the possibility of a low-cost approach to an unusual degree of convenience and flexibility in i-f bandwidth selection for any HF to VHF receiver.

This article explores some ways in which these diodes can be used to build up continuously variable i-f filters of different ranges of selectivity. Such circuits can be applied to HF receivers with bandwidths ranging down to a narrow CW bandpass or to VHF FM where it may be desired to use additional selectivity to reduce splatter from adjacent channel repeaters.

Normally, i-f bandwidths are selected in fixed steps by switching in mechanical, crystal or multiple section LC filters of different bandwidth characteristics. As was mentioned before, some expensive receivers do use a continuously variable LC filter such as illustrated in Fig. 1. Special components are required for the multiple tuning arrangement and the bandpass tunable filter is usually supplemented by other filters which define the overall bandwidth within which the bandpass tuning feature functions.

The tunable bandpass filter in Fig. 1 is made up of a number of series connected parallel LC sections with a fixed amount of capacitive coupling between the LC sections. If another approach were taken, namely to have each LC section fixed tuned at the i-f center frequency but vary instead the degree of coupling between the LC sections, one would have a fixed center frequency filter of variable bandwidth. Such a filter could consist of two or more LC sections with variable coupling. A two to three section will usually suffice when it is supplemented by a fixed filter which established the overall maximum i-f bandwidth. The building of a fixed-frequency variable bandwidth i-f filter by means of varying the capacitive coupling between LC sections is possible, but

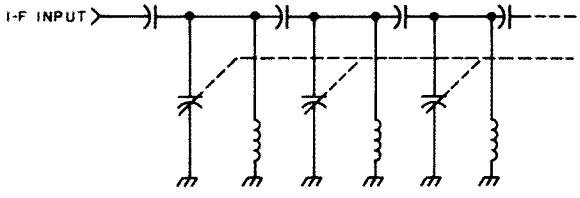


Fig. 1. Development of a tunable bandpass filter.

becomes extremely complicated using normal air variable capacitors because of the requirement to isolate each section of the capacitor. However, it is here that varactors come into their own. Many types are available today which have a capacitance range of 5:1 or 10:1. This range might cover 10 to 400 pF but it comes close enough to build practical circuits.

Fig. 2(a) shows a two section variable bandwidth filter built around a single varactor diode. The circuit values given are those applicable to a 455 kHz i-f but the circuit can be adapted to any other i-f frequency by proper selection of LC elements which resonate at the desired i-f. The selectivity depends upon the Q of the tuned circuits involved and the number of circuits used. These values can be calculated by the standard handbook formulas for any desired response. By varying the bias on the varactor

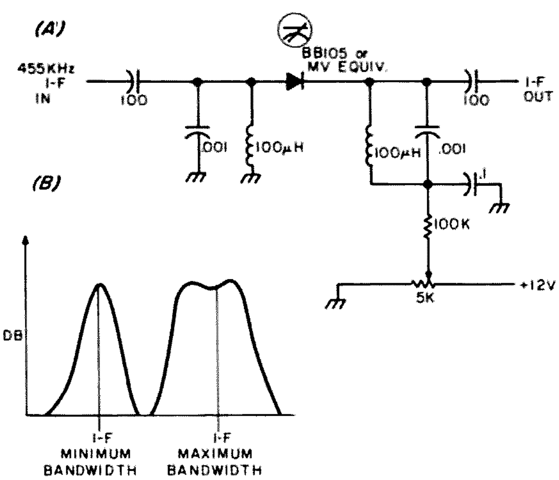


Fig. 2. Basic variable selectivity circuit.

diode, the selectivity response of the circuit can be varied over the extremes shown in Fig. 2(b). Because there is only a dc bias on the varactor diode, the dc lead after the 68k resistor can be any desired length. As can be seen from Fig. 2(b), the simple circuit has one disadvantage. The selectivity circuit is not completely symmetrical about the center i-f frequency. The shift in the selectivity bandpass around the center frequency may not be serious although it may require touch-up of the receiver's main tuning while varying the i-f bandwidth circuit.

For some types of receivers, particularly crystal-controlled ones, it would be desirable to keep the bandpass shape of the selectivity

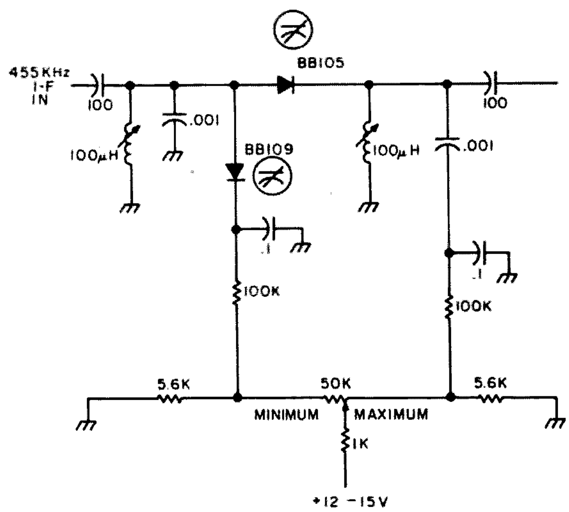


Fig. 3. Variable selectivity circuit with compensation.

curve symmetrical. A circuit for doing this is shown in Fig. 3. The lack of symmetry occurs in the circuit of Fig. 2 because as the varactor diode capacitance changes, it changes the resonant frequency of the tuned circuits. By using two diodes on the circuit of Fig. 3, a compensating arrangement is provided. In Fig. 3 the two tuned circuits are no longer peaked at the same frequency. Each is peaked at a different frequency at the extremes of the desired bandwidth with the circuit pot set to the widest bandwidth position. Diode D1 in Fig. 3 controls the selectivity by varying the degree of coupling between the tuned circuits, the same as in the circuit of Fig. 2. However, as the coupling is varied the tendency of the bandpass curve to shift lower in frequency is compensated for by tuning the first LC circuit to a higher frequency via the capacitance change of diode D2. The bandpass shape remains the same as in Fig. 2(b) except that it doesn't change in relation to the center i-f frequency. The circuit also has advantage of being able to provide a somewhat greater selectivity range. The circuit of Fig. 2 can operate over about a 4:1 range. That of Fig. 3 can operate over a 5:1 or greater range, depending on the component values chosen. So, it would be possible with the latter circuit to achieve a selectivity range which goes from 500 Hz for CW reception to about 2500 Hz for SSB reception.

. . .STAFF

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Phone Patching - a Public Service

In 1964, after 45 years of CW and no AM operating, I decided to go sideband. I had only been on about a month when I was broken one night by KC4USB, Byrd Station, Antarctica. I was using a pair of phased verticals at the time and just signing with a Houston, Texas station. I turned the pattern south, and asked who it was and what I could do.

He said, "You are one of four stations who come into the Antarctic well every night, and we wonder if you could run some phone patches for us." I didn't have a phone patch, but I soon acquired one. In the meantime I offered to run some one-way messages, and KC4USK broke in with a request for a one-way message to Michigan.

The first message was copied through heavy static, with many repeats, and was a request from Ross Smith, who designed most of the antenna installations for the Ice. He wanted a recipe for his mother's sugar cookies. His mother gave me the recipe on the phone, and Ross said that Bob Smart, the cook, and one of the operators at KC4USK, Eights Station, had promised to bake the cookies if Ross got the recipe.

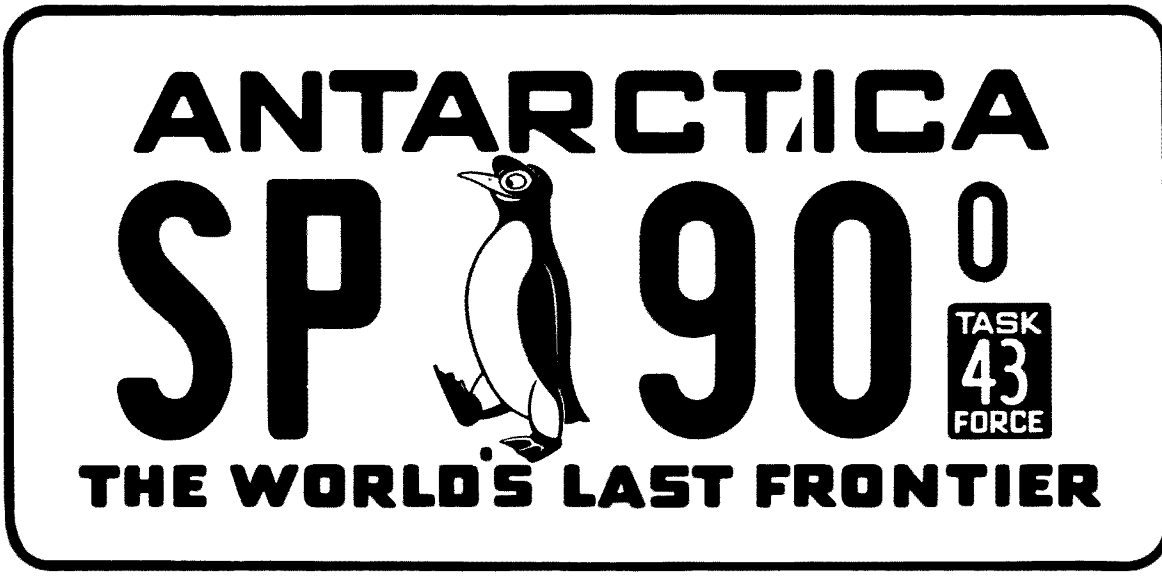
Well, that started my ten year stint of 40 meter phone patching for a total of twenty stations in Antarctica, including a bunch of ice breakers and supply ships. I would run anywhere from two to twenty patches each night and after ten years I learned a great many things. I will tell some of the common errors which one hears.

Probably the most annoying is the habit hams have of joining in the conversation. He seems to feel that he is an entertaining wit, and when the wife says something to her husband and he laughs, this ham feels that he must assert his rights as a wit, and they have to listen while he demonstrates what a real live wire he is. One of the best known phone patchers has this affliction, and I remember one night a Navy man at Byrd Station remarked, "It costs me more for Charlie to talk to my wife than for me to talk to her."

The people whom you are patching are trapped. You are doing them a favor, they feel, and they can't tell you to "SHUT UP," which they would like to do, so they take it as well as they can.

There is another type who wants to make an impression, so he keeps the patch on the line while he explains to the operator that he is a radio amateur running overseas patches for service men in Antarctica, or wherever, then he keeps the operator on the line while the phone rings, and the party answers. First, to broadcast an operator or anyone without their PRIOR permission is a violation of the secrecy of communications act. Second, the person who answers the phone may be a wrong number, which at 3:00 am may get you a broadcast cussing out. Third, you may cause a divorce, as one operator running traffic for the Antarctic did several years ago. He left the line open, and a baby sitter answered the phone. When asked if Mrs. Smith was there, she said, "No, she's out with her boy friend." This was totally uncalled for and there are many more things that may happen when you connect a phone to a worldwide broadcast without notifying and getting permission to put someone on the air.

The other reason why it is very selfish to hold the line open is that the operator on the ship or other service location cannot talk to anyone else while you are gabbing. The old pros who run most of the traffic to service men keep the line absolutely silent until the party answers, and then say,



"Break, your party is on the line." During this silent time the ship can line up another patch with another station, or can accept breakers, or talk with someone else. The neophytes are usually so impressed with themselves that they do not think that any other station is of any importance whatever.

Another bad habit that some stations have is chatting among themselves when they cannot hear the patch which they know is going on. This is especially true with Antarctic patches. The real problem is receiving the ice stations, and often they are reading you Q5, but you can't hear them because of local summer static. I have many times asked for repeats because other well-meaning stations on the West Coast, while waiting for the propagation to favor them, sit and talk back and forth on frequency, full power. Just thoughtlessness, of course, but the result is very annoying.

I can patch an Antarctic station most of the time if he is S-3 or better, and he can patch me at S-0 if he has no snow static, yet strong stations will talk on frequency.

I had a long argument, and finally had to move because a ham would not believe I was running a patch because he could not read the station at the other end. He claimed I was running a monologue to get him to move!

You would be surprised how many stations resent phone patches, and will move as close as possible to you to give you trouble, and then sit there and discuss how they feel about "tying up the band with phone patches." This is public service for people who have no other way of communicating. As a matter of fact, that is my criterion. I will not run a patch for anyone who has any other means at his disposal, unless he is in the service or Peace Corps.

So much for the problems, now for some of the methods. I never explain anything to an operator. It is none of her business, and trying to explain to those who seldom get patches just ends up in a conversation with the supervisor.

I have run thousands of patches, and I have a very simple formula. When the operator answers, I say, "Station to station collect 614-335-4478, and tell them Joe is calling." She will dial the number and ask my number. I say, "1160." When the party answers she says, "I have a collect call for anyone from Joe, will you accept the charges?" Of course there is an enthusiastic, "I sure will!" I then say, "This is Jerry in Ohio, and I have Joe on the line, he will talk first, and when he says 'OVER', it is your turn to talk." If this is not a first time patch, you don't need the last part. Usually the calling party will tell you if it is a first time patch. If not, ask him, I say only "Ohio" because they remember that easily, and if I were to say Washington Court House, Ohio I would start a long explanation. But I want her to know when she gets her phone bill why the call is there. I have NEVER had a call questioned in ten years.

If the band becomes unusable, I cut the patch and tell her he will call her another

time when conditions are better, and they usually accept that. I never tell her to expect another call in a few minutes or an hour. She might be up all night for nothing. Often they will ask my name and be in the mood for talking, and if so I talk, but not on the air. I tell them about the place where her husband is, and the weather, etc., and finally she says goodnight. Sometimes they ask for my address, and send me nice letters, or even some beef "jerky" and canned Columbia River Trout (once).

One couple phoned me when their son came back from overseas and I met them in Dayton. They took me to dinner and we spent the evening together. They even brought me some nice souvenirs, photos and New Zealand money. I have received over 2,000 color slides of places around the world.

Whenever they ask if there is anything they can do for me, I say, "Yes, send me a color slide of the station and yourself, if you have any." Usually they shoot a roll and send it to me unprocessed, and I process it, keep a few, and send the rest to their home address.

There is one thing which makes the Antarctic different than anywhere else. The call letters are issued to the Admiral under whose direction Antarctica operates. He may let anyone, with no license, operate the equipment providing they are checked out on it by a Navy operator. Thus very few of the men who run the traffic are amateurs. They are doctors, scientists, bull dozer operators, dentists and others. So I smile when I hear a ham describing his equipment to the poor guy, who doesn't even know what the ham is talking about, but they listen politely, and then say, "We are running all Collins equipment."

Another thing is that the men who are running patches are doing it because it is a pleasant diversion, but mostly they just want to talk. They look down on what they call the "big score guys", who just want to see how many patches they can run. Some will limit the patches to five minutes just to get more run. I will never make any limit. If the station of origin wants the time limited because they have a heavy load, I let them do it, and let them stop the man on the patch.

Some of the most hated hams are the ones who run big scores, and move off the minute they are through, without waiting to learn anything about the man they have been talking to. They feel you are "using" them for your own "score." We used to have a "coffee klatch" on 7210 in the old days when I was patching for seven Antarctic stations, and when all the traffic was run, sometimes at 5:00 am my time, all the stations and many of the hams would join and "yak" and have coffee till daylight took the band out. One morning I patched South Pole station direct to the Pentagon at noon for orders, after running all night on 40 meters.

Whenever an operator lets it ring a few times and there is no answer I always ask her to re-dial it. You would be amazed at how many times the operator has misdialed. One night I knew this woman was going to the hospital for a checkup, and I had arranged to call her the night before so her husband could talk to her. The phone rang and rang. I asked the operator, a new one, to re-dial the number and she said, "Sir, I dialed the number you gave me." I said, "Would you rather I called your supervisor to re-dial it?" She dialed again and it was answered on the first ring. The operator apologized.

If the phone is busy, I ask the operator to make it an urgent call. I ask her to break in and tell the party that her husband is calling. This almost immediately gets a reply, "I can ring, now." I thank her. Only once did an operator turn me over to her supervisor. She

asked the nature of the emergency. I said, "Are you married?" She said she was. I said, "Your husband has just left Seoul, Korea, on a Naval Repair ship. You have not heard from him for nearly a year. He has stood in line for hours waiting for his turn. If he loses his place he may not be able to call again for a week, radio communications being what they are. Is that an emergency?" She replied, "That IS an emergency," and promptly cut in on the line and put me through. For the purists, please remember that the man who is calling is the man who is paying for the home phone, and he wants to use it!

One of the troubles you will have is letting a 2600 Hertz heterodyne come in. That is the switching frequency and you may lose your circuit. I lost one four times one night to Washington State. I asked the operator what the trouble was and she told me that a high pitched note was cutting my circuit. Now I carefully squeeze it out of the pass band or zero beat it if I have trouble.

Of course you NEVER use Vox for a patch unless you are running one between two S9 hams. The sound of the Vox operating, and letting bursts of static and other noises through will thoroughly demoralize most people on a patch.

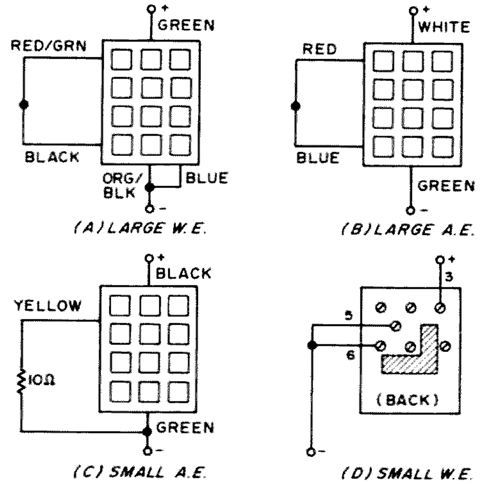
My most unusual patch happened on November 14, 1965. Eights Station had just closed, and all the men had taken a plane to McMurdo Sound. I wanted to see if they had made it, so I called McMurdo station, and found that they were all there, and the station at Eights was permanently closed. I had worked them every night except three for a whole year. Suddenly I got a "Break". I said, "Go ahead breaker."

"This is KC4USC. Are we patch quality?"

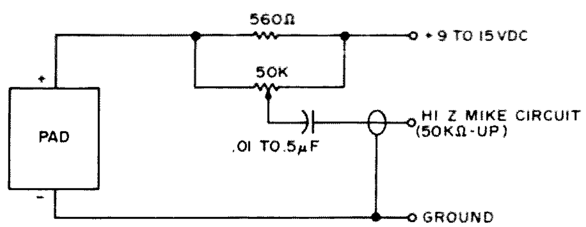
I told him that he was, and he wanted to run a patch to California, which I did. When he was through I asked him where he was. "We are on Pensacola Mountain in two helicopters. When we heard you we landed and ran a wire between the two copters and gave you a call." Pensacola Mountain is near the South Pole and is 12,000 feet high, and this was in pitch darkness in the Antarctic Winter.

...W8HXR

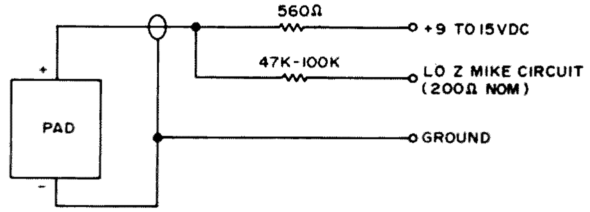
CIRCUITS, CIRCUITS, CIRCUITS...



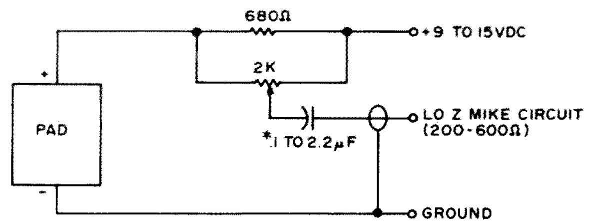
Here are the four most popular TT pads and how to hook them up. Tape all unused leads so they don't short out. Be careful of polarity of the pad and power supply. All pad circuits here from WR9ABN newsletter, Box 342, Ft. Wayne, IN 46801.



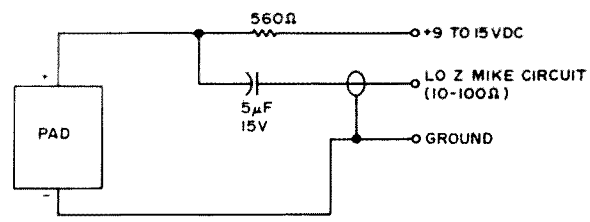
Hooking a pad to a low impedance dynamic mike input circuit such as in the Standard, Icom, Drake-Trio, Clegg, etc.



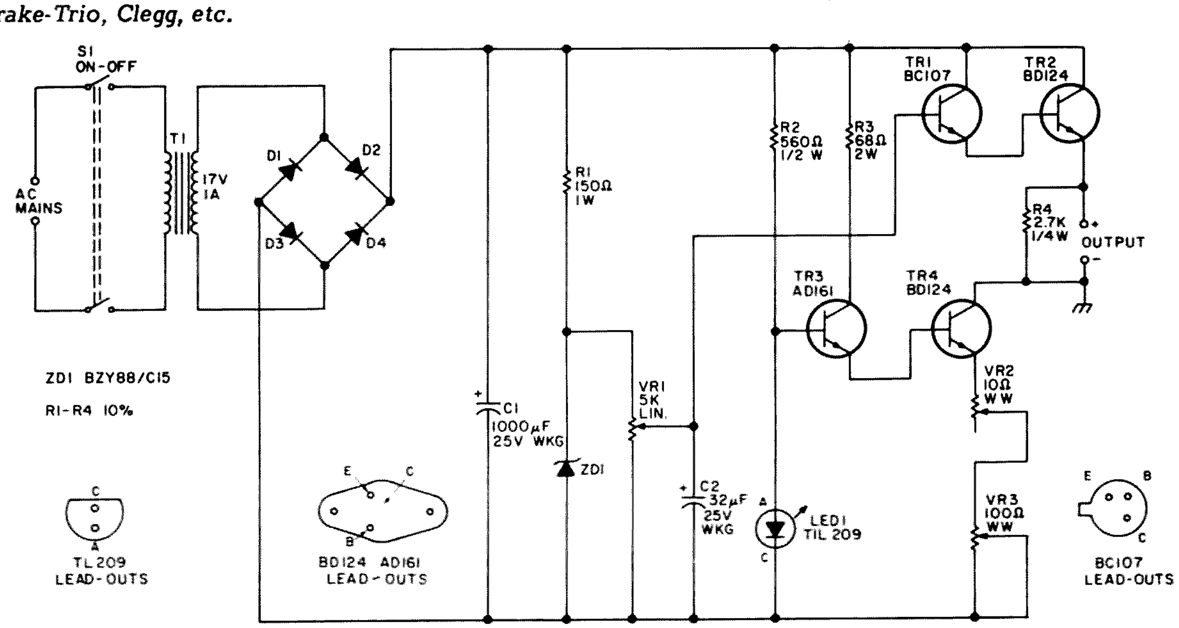
Another low impedance dynamic mike input circuit match for the pad — uses only two resistors and may be wired into the accessory plug — only two leads to the pad. Works with Drake-Trio TR-72 and may work with a few other rigs.



Hooking a pad to a low impedance carbon mike circuit; tube type Motorola, G.E., RCA, Dumont, Aerotron, etc.

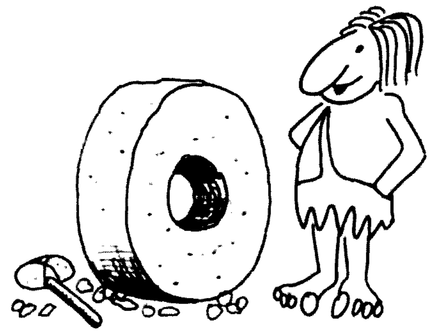


Hooking a pad to a high impedance ceramic mike input circuit — Regency, Genave, etc.



Current limiting power supply. Output voltage is controlled by VR1 and limiting current level by VR3. D1-D4: 2 A silicon rectifiers in metal encapsulation; they may have a piv rating of 100 V or more. (From Radio and Electronics Constructor, February, 1975)

NEW PRODUCTS



HEATHKIT HD-1250 SOLID STATE DIP METER

Almost every ham at one time or another finds himself in need of a grid-dipper. For many applications, no other instrument can be used in its place. Even the so-called "appliance operator", who never builds any gear himself, will sooner or later need a dipper to check a tuned circuit or prune his antenna.

Strictly speaking, the old fashioned grid-dipper has gone the way of spark gaps and galena detectors. Modern circuits are solid state and there is no longer a "grid" to "dip". Until lately however, the few dip meters that have been available were either bulky, inconvenient to use due to power requirements, or too expensive.

The new Heathkit HD-1250 Solid State Dip Meter is a winner on all counts, and should prove to be one of the most popular ham-type kits ever produced. Added to the Heath line of products in January of this year, this is an updated and vastly improved version of their old familiar grid-dipper which was discontinued more than ten years ago.

The HD-1250 circuits are comprised of an NPN transistor functioning as a balanced Colpitts rf oscillator, coupled to a broadband amplifier/detector using a dual-gate MOSFET and two hot-carrier diodes. Components are mounted on two small printed circuit boards.

In the injection mode the oscillator generates a signal which is coupled into the circuit under test, and the detector section amplifies and rectifies the voltage impressed across the plug-in tank coil. The average dc value of this voltage is indicated on a 150 microamp meter.

In the absorption mode the oscillator section acts as a Q-multiplier and the MOSFET amplifier boosts weak rf signals to a usable level to provide an indication of relative signal strength. In this application the dipper can be used to neutralize amplifier stages, check for parasitic oscillations, or measure field strength.

Frequency coverage is 1.6 to 250 MHz in seven ranges. The prewound plug-in coils and precision tuning dial ensure simple calibration of the unit without the necessity of using auxiliary lab equipment. All you need is a receiver to check signal output at several points across the tuning range. Accuracy of the dial calibration at the extreme ends of each band is quite impressive.

Mechanically this new kit is a dream. A compact handful measuring approximately 2" x 2" x 6", the various cabinet panels, chassis and dials fit together in a neat, close-fitting fashion to make up a package which rivals or surpasses the precision finished appearance of many commercial instruments. And the self-contained 9 volt battery allows the dipper to be used for antenna work just as conveniently as on the bench. An added feature is the attractive shock-padded molded carrying case with individual storage slots for each plug-in coil.

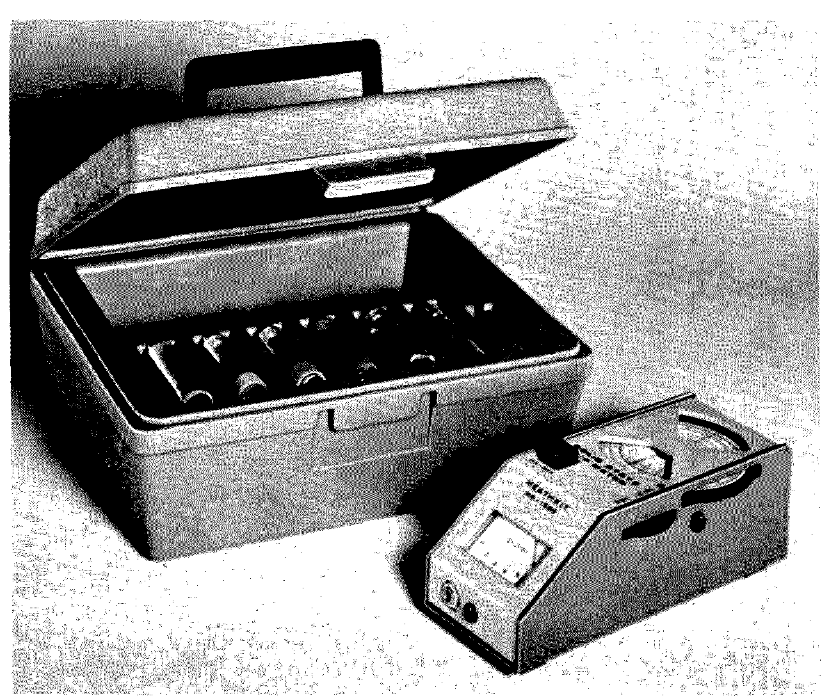
The superb assembly manuals written by the people in Benton Harbor are legendary, and the book furnished with this kit is one of their finest efforts. The detailed step-by-step instructions ensure that even first-time kit builders may put one of these together with full confidence that the unit will operate properly when completed.

Assembly and wiring of the kit took me less than three hours, but I was anxious to get it working so I could tune up an inverted vee that wouldn't load properly on 40 meters. Even at a leisurely pace you can figure on no more than 5 to 6 hours at the outside, including calibration.

The manual also contains 16 full pages of operational information listing many applications for the instrument, with illustrated instructions about various test procedures.

After you get your hands on one, I think you'll agree that the Heathkit HD-1250 Solid State Dip Meter is a real bargain at its modest price of $59.95. It's sure to become one of the pieces of test gear most used in your Hamshack.

. . . W6QJM



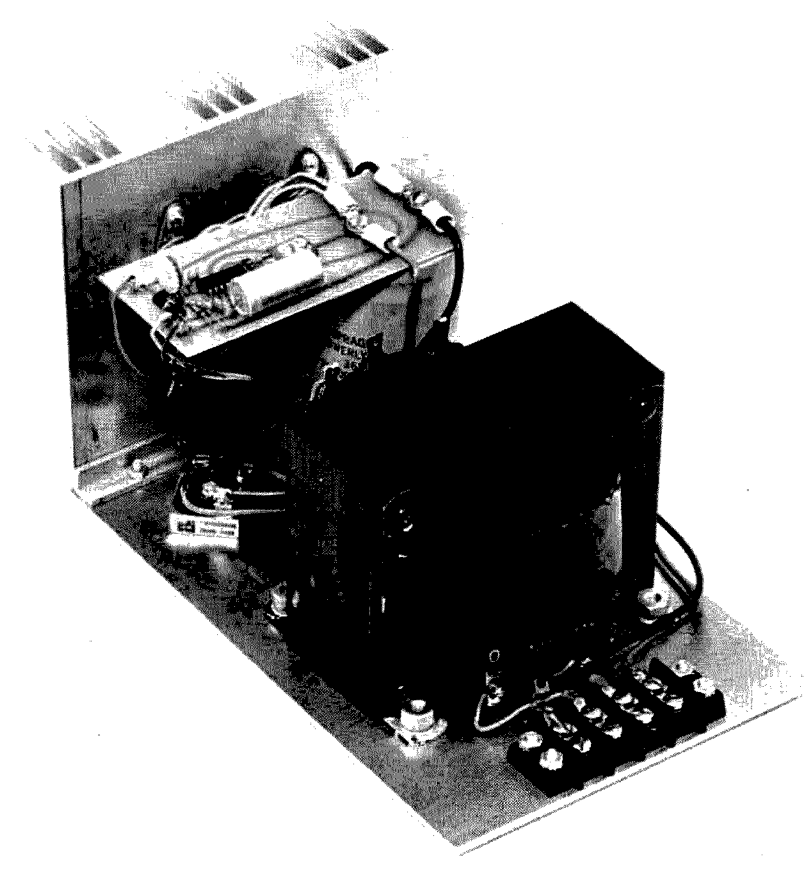
VHF Engineering

12 and 24 Amp Power Supplies

PS-12.

High current power supplies are an absolute requirement in commercial two-way radio shops and are now on the verge of becoming a requirement in the ham shack. Most of the new equipment being released for the amateur market for the LF/VHF/UHF bands is of solid state design and thus designed for 12 V operation either mobile or from a fixed station 12 V supply. The 12 V fixed station supply has in the past been a problem, since high current, well regulated supplies tend to be complex and expensive to build while commercially available supplies are even more expensive and are frequently in short supply. VHF Engineering, of Binghamton, New York, has recently announced two inexpensive solid state 12 V power supply kits which are simple to construct and can be used in either commercial or amateur applications to power LF/VHF/UHF equipment in the repair shop or in the base station. The power supplies may be used with FM, SSB or other equipment requiring pure 12 V dc at currents up to 24 A.

The circuit for both power supplies consists of a full wave dc current source feeding a capacitive filter network and an integrated circuit regulator (Signetics NE550). The IC regulator controls a set of pass transistors and keeps the output voltage consistent to within 2% over a load range of from 0 to 20 Amps (0 to 10 Amps on PS12). Both power supplies have large heat sinks mounted on the back of the cases to dissipate the heat produced by the pass transistors. The 12 Amp supply is rated at 10 Amps continuous or 12 Amps for 50% intermittant duty. The 24 Amp supply is rated at 20 Amps continuous or 24 Amps for 50% intermittant duty. Current limiting is provided to prevent damage to the supply in the case of an accidental short circuit. In the event of a short circuit across the power supply terminals, the output voltage drops to a low value and the output current is limited to a maximum of either 12 or 24 Amps (depending on supply) until the short is removed. When the short is removed, the output voltage rises to the nominal 12 volt value.



PS-24.

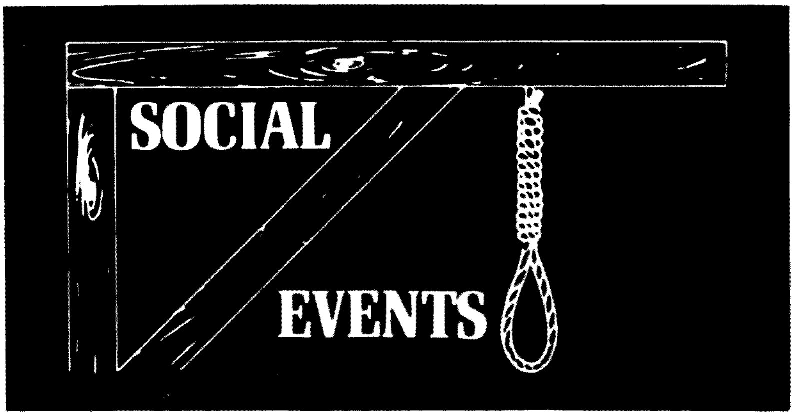
The output voltage of the supplies may be adjusted over a nominal range from 12-15 V. Both supplies may be utilized as general purpose, variable voltage supplies by replacing the voltage controlling resistor by a 10k Ohm pot.

The VHF Engineering power supply kits are supplied in kit form complete with all parts, computer grade capacitor, epoxy glass circuit boards, styled case, and complete instructions. Average construction time is an evening or less.

The uses of these quality power supplies are endless. A large number of commercial two-way radio firms are using the VHF supplies both as bench supplies and as supplies for commercial repeaters. Amateurs are using the supplies for powering solid state SSB at the home shack, and one of the biggest uses is for the FM operator. The FM operator can operate the mobile transceiver and the mobile power amplifier from the base by using one of the VHF Engineering supplies. These supplies are also being used in a large number of amateur repeaters.

The VHF Engineering power supplies are available from VHF Engineering, 320 Water Street, Binghamton NY. They cost $69.95 and $99.95 for the PS12C and PS24C kits, respectively. They are available wired and tested for $85.95 and $114.95, respectively.

. . . W1HCI



HEAR PROSE SPEAK
(or)
"HERE, PROSE . . . SPEAK!"

Spend the Fabulous Fourth of July weekend at the 47th annual Atlanta Ham Radio Festival and ARRL Georgia State Convention. Center of activity will be the Royal Coach Motor Inn, I-75 North, July 5th and 6th.

Highlight of the Festival will be the Saturday night banquet with Keynote Speaker, FCC's A. Prose Walker whose topic will be, "Docket 20282 – Restructuring."

Activities cover all phases of amateur radio including ARRL Forum, FCC examinations, biggest flea market and manufacturer's display in the south, special events for XYLs and Junior OPs, Sunday afternoon grand prize drawing, MARS meetings, technical programs, something of interest to every ham and his family.

Pre-registration – $2 per person or $4 per family ($3 or $5 at hamfest). Special hamfest motel rates $16 single and $21 double (children under 13 free).

For more info write: Atlanta Ham Radio Festival, P.O. Box 76553, Atlanta, Georgia 30328.

VANCOUVER BC
JULY 11-13

Maple Ridge Hamfest is being held on July 11, 12 and 13 at the Maple Ridge Fairgrounds approximately 30 miles east of the city of Vancouver on the north side of the Fraser River. The hamfest includes: Technical seminars and displays; contests for the women and children, as well as the OMs; a hidden transmitter hunt; mobile judging; technical IQ quiz; home brew equipment contest; commercial displays; two meter home brew antenna contest; Saturday evening meal. Registration: At the door, $3.00 no meal, $7.00 with Saturday meal. Pre-registration available for $6.00, cutoff date June 30. Overnight parking for trailers and campers plus spaces for tents available for $2.00, but no hook-ups. VE7MRC will be monitoring 146.94, 146.76, 146.79, 147.33 and 3970, 3755 for talk-in purposes from 1600 July 11 on.

OAK CREEK MI
JULY 12

The South Milwaukee Amateur Radio Club 5th annual Southeastern Wisconsin Swap-Fest will be held Saturday, July 12, 1975 at Shepard Park (American Legion Post 434), 9327 South Shepard Avenue, Oak Creek MI. Activities begin at 7 am to 5 pm or later. Admission $1.00, includes a "happy hour" with free beverages. Prizes will be awarded. Talk-in on 146.94 MHz FM. For more details write South Milwaukee Amateur Radio Club, S. F. Schreiter W9AKF, Sec., 104 Brookdale Drive, South Milwaukee WI 53172.

CHARLESTON SC
JULY 12-13

The Charles Town Hamfest will be held on July 12-13, 1975 in Charleston, South Carolina. For more information write: P.O. Box 12502, Charleston SC 29412.

INTERNATIONAL PEACE GARDEN
JULY 12-13

The 12th Annual International Hamfest is scheduled for July 12 and 13, 1975 at the International Peace Garden between Dunseith, North Dakota and Boisseuain, Manitoba. For further information contact: John McCann WBØFUO, 1234 Valley View Dr., Minot ND 58701.

CARY NC
JULY 19

The Cary ARC will hold the third annual Mid-summer Swapfest, Saturday, July 19, 9 am – 3 pm. A la carte cookout, 11:30 am. Auction, 12:30 pm. Doorprize drawing, 2 pm. No commissions charged. Talk-in 146.04/64, 146.22/82, 146.28/88, and 222.34/223.94. At Lions Club Shelter, Cary, NC (near Raleigh). For info, SASE to K4FBG, 1022 Medlin Drive, Cary NC 27511.

CROSSVILLE TN
JULY 19-20

The Oak Ridge Amateur Radio Club, Inc. Annual Crossville Hamfest is July 19-20 at Crossville TN. July 19 highlights are technical forums and a banquet; July 20 features a picnic, flea market and a raffle of many prizes. Events will be held at the local Holiday Inn and at nearby Cumberland State Park.

McKEESPORT PA
JULY 20

The Two Rivers Amateur Radio Club of McKeesport, Pa., will hold their 11th Annual Hamfest on July 20, 1975 at the Green Valley Volunteer Fire Station Grounds off the East Pittsburgh-McKeesport Blvd. Talk-in on 146.52, .22/.82 and 29.00 MHz. For further info, contact Donald J. Myslewski K3CHD, 359 McMahon Road, North Huntingdon PA 15642.

PHILADELPHIA PA
JULY 23-25

The ARRL Atlantic Division Convention will be held on July 23-25, 1976 in Philadelphia at the huge Benjamin Franklin Hotel. This is expected to be a very large gathering. Firms wishing to exhibit should contact Ken Miller W2KF, 309 Cherry Hill Blvd., Cherry Hill NJ 08034.

FLAGSTAFF AZ
JULY 25-27

Ft. Tuthill Summer Hamfest, Coconino County Fairground. Flea market, contests, social activities, pot luck, etc. Grand prize: FT-101B. Location: South of Flagstaff on I-17 across from airport. Talk-in on 146.94 and 3992.

OKANAGAN VALLEY CANADA
JULY 26-27

The 25th Anniversary Okanagan International Hamfest will be held July 26th and 27th, 1975 at Gallagher Lake KOA Campsite – 8 miles North of Oliver, B.C. Canada. Grand prize raffle draw: IC-22A. Prizes, entertainment for hams, XYLs, YLs and harmonics and visitors. Call-in frequencies: 3800 on 75 M, 34/94 OKN Rpter, 76/76 Simplex on 2M. Regis-

tration: 9 am PDT, Saturday July 26th. Activities: 1 pm PDT, Saturday – 2 pm PDT, Sunday. For more information contact: Kirk Carter VE7DV, 450 Vista Rd, Kelowna, B.C.

TRAVERSE CITY MI
JULY 27

The Cherryland Amateur Radio Club annual family picnic and trunk swap and shop welcomes all Northern Michigan hams to their picnic July 27 at Whitewater Township Park in Williamsburg (just outside of Traverse City). Bring your wife and kids, your food and drinks, and be prepared for a good old fashioned picnic with boating, fishing, swimming, swings and play for children, lots of picnics tables and grills, a pavilion and a place for pop to park his trailer overnight. It's a freebee – no charges – for details write to W8GI, Box 176, Kingsley, Michigan 49649.

ROCKVILLE IN
JULY 26-27

The 28th annual Turkey Run Hamfest and VHF Picnic sponsored by the Wabash Valley ARA, Inc., will be held Sunday, July 27, at Turkey Run State Park near Rockville, Indiana. Don't miss the midwest's finest flea market. XYL Bingo, refreshments, camping facilities and park recreation for the kids. Also this year, banquet July 26, 7:30 pm featuring guest speaker W9NTP, in park dining hall. Banquet by reservation only, $6.50/person. Activities begin 9 am Sunday, talk-in 146.94 W9UUU/9. For more info SASE WVARA Hamfest, Box 81, Terre Haute IN 47808.

TEMPLE TX
AUG 1-3

The Texas VHF-FM Society will hold its Summer Convention 1975 Aug 1, 2 and 3 at The Ponderosa Inn in Temple, Texas. This year's convention will be the best ever with the featured speaker Mr. A. Prose Walker, Chief of the Amateur and Citizens Division of the FCC. There will also be equipment displays, technical sessions, a swap-fest, ladies activities and many, many prizes. For more information contact the Temple VHF Repeater Association, PO Box 23, Temple, Texas 76501.

OKLAHOMA CITY OK
AUG 2-3

The Oklahoma Ham Holiday and State ARRL Convention will be held Saturday and Sunday, August 2 and 3 in Oklahoma City OK. In addition to the largest flea market in the Southwest, the program will include special programs, technical seminars, equipment displays. MARS meetings and unique activities for the XYL. For information and advance registration write Oklahoma Ham Holiday, P.O. Box 20567, Oklahoma City OK 73120.

MONTREAL
AUG 3

Montreal Hamfest 75 will be held on August 3, 1975, at MacDonald College Farm, Ste. Anne de Bellevue. Prizes, giant fleamarket, technical sessions, family fun. Adults $2.50. For information contact: VE2RM, Box 201, Pointe Claire-Dorval, Quebec H9R 4N9.

LEVELLAND TX
AUG 3

The Tenth Annual Northwest Texas Emergency Net Swapfest and Picnic will be held in the City Park at Levelland, Texas on Sunday, August 3, 1975. Bring your own picnic basket. Free registration begins at 0900. Lunch at 1300. Swapping all day. This event is for the entire family. Mobile talk-in is the net frequency of 3950 kHz and via the Levelland Repeater (WR5AFX), on 28-88.

CANTON OH
AUG 3

Hall of Fame Hamfest and Auction rain or shine, Aug 3, 1975, Canton, Ohio. Come to Canton for football's greatest weekend. Saturday's activities – parade, enshrinement, NFL game Cincinnati vs Washington. Sunday – hamfest and auction at Stark County Fairgrounds. Main prizes – ICOM 230 – Hallicrafters FPM 300 – Standard 2 mtr hand held. For more info write WA8SHP, 73 Nimishillan St., Sandyville OH 44671 or call W8SWB at (216) 455-4449.

UPPER ST CLAIR PA
AUG 3

The 38th Annual Hamfest of the South Hills Brass Pounders and Modulators will be held on August 3rd, from noon till dusk, at St. Clair Beach, Upper St. Clair Township, 5 miles south of Mt. Lebanon on route 19. Swap and shop, picnic space and swimming for the family. Mobile check in on 29.0, 52 simplex and popular 2 meter frequencies. Information and pre-registration at $1.50 per ticket ($2 at door) from Fred Schreiber, 181 County Line Road, Bridgeville PA 15017.

WASHINGTON MO
AUG 3

The Zero-Beaters ARC will hold their annual hamfest on Sunday, August 3rd, at the Washington, Missouri city park. Free parking, auction, and bingo for the XYLs. No admission fee or fee for parking in the traders row. Many prizes including IC-22A, station accessories, books and a handmade quilt. For info or tickets contact Kevin Weiskopf WBØMNP, or Zero-Beaters ARC, WAØFYA, Box 24, Dutzow MO 63342.

FLOURTOWN PA
AUG 10

The Mt. Airy VHF Radio Club (The Pack Rats) will hold their 19th Annual Family Day & Picnic on Sunday, August 10, 1975 (rain date August 17th) at the Fort Washington State Park, Flourtown PA. The Delaware Valley chapter of QCWA will again join us in the festivities. All hams and their families are cordially invited. Games and entertainment, free prizes to the kiddies, free soda. Talk-in on 52.525 MHz FM – 146.52 MHz FM – 222.98/224.58 MHz FM repeater. Registration $2 per family.

WILLOW SPRINGS IL
AUG 10

The 41st Hamfest and Picnic will be held Sunday, August 10, 1975, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OMs and XYLs, famous swappers row. Information contact John Raiger K9DRS, 8919 West Golfview Drive, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 South California, Chicago IL 60629.

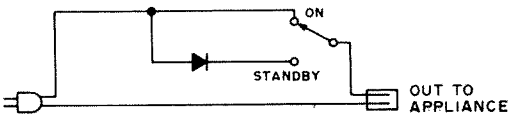
YANKEE LAKE OH
AUG 17

The Warren Hamfest will be held Sunday, August 17, Yankee Lake, Ohio, on Rt. 7 five miles north of I80. Dealers' displays. Swimming and picnicing. Giant flea market (Vendor's fee: $1 plus reg.) A $3 reg includes: Door prize, main prize and XYL tickets. More info: Hamfest, PO Box 809, Warren OH 44482.

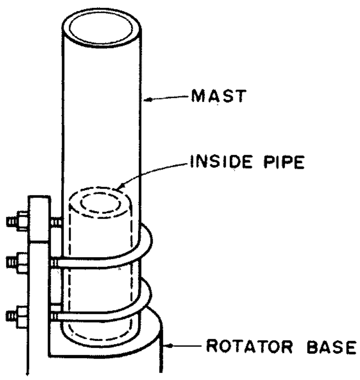
DECATUR AL
AUG 17

The Decatur Amateur Radio Club will host the North Alabama Hamfest in Decatur, Alabama on Sunday, August 17, 1975. Location is the campus of Calhoun Junior College at the Decatur-Athens Municipal Airport. Doors will open at 8 am. Tickets $1.00 each will be available at door or in advance from Ken Hixon WB4NLN, P.O. Box 9, Decatur AL 35601. Talk-in on 34-94 and 3.965 MHz.

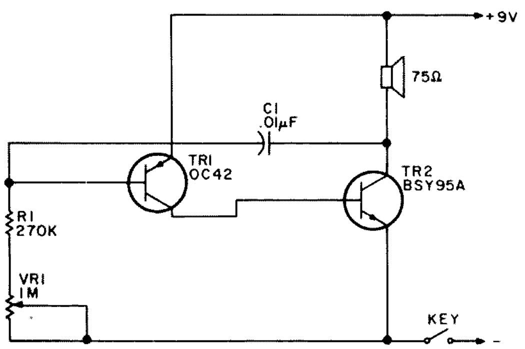
CIRCUITS, CIRCUITS, CIRCUITS...



Instant on for ac/dc radios and tv's. On standby about 60 Volts goes through, keeping the filaments slightly warm so they will heat up immediately when full ac is applied. Do NOT use this circuit on equipment with a power transformer. Note: tube life is extended when the filaments are not permitted to cool off. Added note: watch that polarity. —WA3SWS



TV type masts are inexpensive and made of thin metal. Rotor clamps tend to crush the mast. Prevent this by inserting iron gas pipe of next smaller dimensions where clamps make contact. Coat with rust preventative. Tnx WAØKKC.



Morse Code Oscillator. R1 – ¼ W. (From Practical Wireless, March, 1975)

73's Test Lab Clearance Sale

Quartz electronic watch — liquid crystal readout (does not take two hands to read) — sells for $55 — brand new unit provided to 73 to prove watch is first rate — in original box never used . . . only $49.

Multi-2000 2m FM/SSB transceiver — tested for a few days by 73 staff and found to be fantastic — in original box and still brand new — $700 value — just one on hand so first come at $625.

Atlas model 210 transceiver 80-10m — sells for $600 — tried out for a few days in the W2NSD/1 shack and worked like a charm — incredible rig — still completely new with original box — only $540 for first check received.

Emergency Beacon EBC-144 Jr 2m FM rig —$600 price tag — priority channel system — synthesized for all channels, even the splinters — tested out on 73 Mountain, one of the roughest rf spots in New Hampshire and performed beautifully — still absolutely new in original carton — first cashier's check for $550 takes this gem.

Magtech FM Frequency Standard — needs only +12 V to swing — gives standard signal for tuning in all FM repeater channels (30 kHz) — tested in 73 lab — perfect! — sells for $60 — one only, first check for $50.

Venus Scientific SSTV Monitor — used by W2NSD/1 for a couple weeks — works great — still new — cost $349 — first check for $299 takes it — here's a chance to get active on SSTV at a real bargain.

Venus Scientific SSTV Camera — these are very hard to get — almost impossible — and the reason is that they are fantastic — sell for $469 if you could get them (which you can't) — one unit, used by a little old lady at 73 Magazine for a few minutes one Saturday — she was so astounded at the perfection of the camera that she said we should sell it so she wouldn't get addicted. First check for $425 will get us off this problem.

Toshiba Cassette Deck PT-490 with Automatic Reverse, Dolby, record or play for a full two hours straight with a C-120 cassette. One of the very finest Dolby decks out — Cost $350 — used a few days for evaluations and a review — first check for $259 takes this beauty.

MITS 908M calculators — cost $130 — brand new — one of the most useful of the hand calculators — programmable decimal point — X^2 — 1/X - $\sqrt{X}$ — with charger — memory key — only $69.

Corvus calculators — nationally advertised at $70 — brand new, with nicads, charger, has memory — $49.

Herman Cone WB4DBB
Rt. 5 Box 341
Chapel Hill NC 27514

An S-meter for your Swan-250

The Swan-250 can be easily modified so that the existing meter can also serve as a signal strength meter. Only three parts are needed: a 100 Ohm ½ W resistor, a 1k linear pot, and a small signal diode, such as the 1N914. To make this modification, proceed as follows:

Remove ground wire on common side of meter. Remove wire going from (+) meter

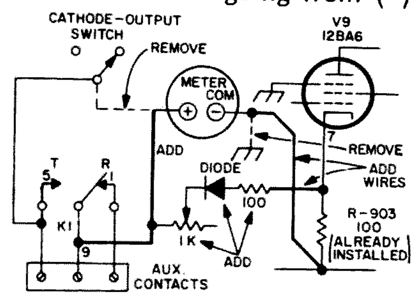


Fig. 1. Schematic for adding an S-meter to the Swan-250.

terminal to cathode-output switch. Connect wire from pin 5 of K1 to cathode-output switch (connect it to the same terminal that was just disconnected). Connect wire from pin 9 of K1 to (+) meter terminal. Connect wire from (+) meter terminal to one side of the 1k pot. (The pot can be mounted underneath the chassis on the rear panel near the 6146s.) Connect cathode (banded end) of diode to middle terminal of the 1k pot. Connect the 100 Ohm resistor from free end of diode to pin 7 of V-9.

Then, find the *already existing 100 Ohm resistor* connected to pin 7 of V-9. Connect a wire from this resistor (R-903) to the common meter terminal. The wire connects to the end of the resistor that is *away* from pin 7 of V-9.

Finally, turn the radio on and wait for it to warm up. Set the 1k pot so the meter rests at exactly full scale (400 mA) with no signal. The S-meter is now complete and you can calibrate it. You will readily notice that it reads backwards, similar to the Swan-350 S-meter.

. . . WB4DBB

NEVER SAY DIE from page 3

Then the FCC came personally to visit! That's hard to ignore.

At 0000 GMT the satellite will change over to mode A again.

Once you start listening to the satellites you will get interested in improving your setup. You'll start reading to find out which antennas work best, whether a preamplifier will pep up your receiver, what kind of antennas are best for transmitting, etc. That's the nice thing about working Oscar, you can get started simply and go as far as you like, complete with tiltable antennas, circular polarization, etc. Don't plan on too much transmitting power, for this bogs down the satellite receiver and ruins things for everyone. A California "QRPer" did the usual stunt and zapped just about everyone out of the passband. Oscar users complained and he ignored them. The Amsat officials requested he lower power and he ignored that. Next came a note from the FCC, and that too was ignored. Then the FCC came personally to visit! That's hard to ignore. Hopefully there are not any other amateurs so intent on spoiling the fun for everyone else.

And *fun* is the name of the Oscar game.

After a few days you'll be an Oscar expert, zeroing in on the chap you want to contact and getting him the first call. If you arrange your station right you'll be able to hear your signals coming back – this helps you know when the satellite has been acquired and gets you on the frequency you want. The time delays involved keep you from getting feedback when you tune yourself in on sideband, by the way.

Ready? Set? GO!

REPEATER FREQUENCY ANGUISH

The jamming up of repeater channels has brought on some mighty unpleasant developments – repeaters going on the air ignoring coordination efforts. It won't take much of this before we'll be right back to the Prose Walker plan for having the FCC allocate repeater channels . . . and this means the slow grinding frustration of one to four year waits for decisions, interminable showings and correspondence, the need for engineers with FM broadcast experience to put together the topographic exhibits, etc. Repeater clubs and councils had better face this situation right now and not let things go any further.

I might remind repeater councils that when I offered to put out a council newsletter a year ago they ignored it with the result that there is virtually no communication between councils. Together we progress, separately we sink, to coin a thought. Perhaps the situation now is serious enough so repeater councils will have the courage to take positive steps and stop sitting around waiting for the ARRL to do something.

One suggestion that has been made is that councils send reports from their frequency coordinators to the publishers of repeater lists indicating which repeaters are pirates . . . or do you prefer to call them uncoordinated? Or outlaw? It would seem time that amateurs be made aware of these outlaw repeaters and that some stigma be attached to flaunting coordination.

Should we put the black hand print on each pirate repeater? Maybe a skull and crossbones?

The other side of the coin is obvious . . . coordinators have a serious responsibility to provide an honest and even-handed service. They should deal out the few frequency channels available in the best way possible, not favoring friends, not holding channels for imaginary repeaters, giving major channels to larger groups and splinters to the smaller groups.

Repeater councils are hereby requested to contact me and let me know what you think of the idea of trying to get amateurs to put pressure on repeaters which ignore coordination. Should we put the black hand print on each pirate repeater? Maybe a skull and crossbones?

Right here in the fringe area of Boston we have a great flurry . . . a small group is totally ignoring coordinating efforts . . . they have a 19-79 repeater on in Maiden now which is pirate . . . and they've just put a 34/94 machine on the air which is jamming another nearby repeater on that channel . . . and seem impervious to reason. The justification is that it is a "bicentennial repeater". They are having the same problem in New York . . . and across the country . . . even in Kansas! Let's get this rotten mess straight . . . and fast.

MICROPROCESSORS

I sure feel like a dummy trying to decipher articles and ads in the computer magazines. These fellows have a language all of their own and they keep the dictionary in their pocket. Well, Never Say Die, right? I'll be damned if they are going to stop me just by being difficult. Between a whole bunch of applications for a computer for 73 business and a nice list of ham applications, I decided that one way or another I would take the rocky path and overcome.

The articles in Poptronics and Radio Electronics on the MITS Altair 8800 microprocessor and video terminals were duly read and mulled. I grabbed anyone with computer knowledge at ham club meetings and did my best to pump them . . . a few were snagged via repeaters and brainpicked . . . Bill Godbout has run up a terrible phone bill trying to defeat my ignorance.

Next we bought one of those Altair 8800 jobs and I sat down, large instruction book in hand, 8800 facing me. After a couple of hours, with a few hints on some computer language translations, and after following rigidly the instructions for programming the unit, I was successful . . . I got it to add two numbers together and come up with the sum. I plunged on recklessly and made up my own program to get it to add three numbers . . . success again!

Thus reinforced by confidence I turned to the next chapter in the instruction book . . . multiplying. Disaster. After four hours of sweat and dither I was nowhere . . . except to the typewriter to write MITS for help. I haven't heard anything from them yet . . . they probably have a problem of their own . . . something over 4000 of the microprocessors out and a ton of mail asking questions. I don't think I'm the only one to bog down.

Southwest Technical has come out with a gadget which may help – a unit which will take a surplus keyboard and provide me with a video readout on a television set. Once this is working I expect I'll be able to hook the unit into the 8800 and speed up the input action.

I'll let you know if I have any success.

Continued on page 160

NEVER SAY DIE from page 158

NEWSPAPER CLIPPINGS

Since there is no way for me to get every newspaper, I'd sure appreciate it if you would keep your eyes peeled for me for items of interest . . . clip them out . . . and send them along the next time you get a chance. I sure don't want to miss anything having to do with amateur radio, particularly good PR . . . also of interest are CB misery items, IRS (sob's), UFOs, Oscar, stuff like that. Quite a few readers seem to be doing this already and I want to thank them for remembering me.

PREDICTION

Somewhere in the neighborhood of a thousand ham club newsletters are received by 73 each month and I look through every one of them to try and keep up with what is happening. One thing is beginning to stand out . . . more and more clubs are running classes to get newcomers licensed. There has been a major change in this in just the last few months. I predict that this will result in a substantial change in the FCC licensing figures and that we will begin to see a noticeable upturn in the number of hams.

I wish I had the time to write individually to every club that has set up classes to teach theory and code . . . I'm very proud of them . . . they are doing something of great value for all of us. Not a few have written to say that they are using the 73 Morse code cassettes for teaching the code. I spent a lot of time and agony making those cassettes, so I really like to hear when they are helping people. Several people at Dayton mentioned that they were using my Novice theory cassettes for their classes since I had organized the material so well . . . and they wanted to know if I had some in the works for General Class. I've been putting that off . . . it is an unbelievable amount of work to make the theory cassettes and, like you, I tend to do easier things first. If there really is a need, I'll (sigh) get to work.

If your club hasn't yet got license classes going, put a burr under the blanket. Get things organized and then beat the hell out of the bushes, particularly around high schools.

2001?

No, let's make that 1984, that ever popular year for futurists, and look into the Green crystal ball (made of reconstituted quartz and fed by eight of the new Intel 8888 micro-mini super-processor chips). It's beginning to clear a bit as the uart settles down with the fifo and my HDT (holographic display terminal) comes into focus on a full page ad in the latest video magazine for the HCM-2001 Nightmare Machine, only $5500, complete with a ham ticket.

The Ham Communicator Multi-2001 does it all – the full legal 250 Watts on all HC bands – automatically zeros in on any repeater and quickly solves the most devilish of access tone code requirements – reads out the ID in LEDs from CW, RTTY, or ASCII codes – scans – holds up to 24 different basic QSO messages to relieve you of that drudgery – fills out QSL and posts it – records contact in log – keeps track of all pertinent information on everyone you've worked and displays it on any HDT for you – will automatically search all repeaters for any specific station you want and call it – etc.

For an extra charge the HCM-2001 comes with four original scripts for entertaining introductory transmissions – just send your name, a list of the ball teams you like, what kind of beer you drink, and your make and model car so the scripts can be personalized.

Once we've turned ham licensing over to the dealers via docket 20282, we should have no further problems with too little growth. Each rig will come with a 610 form ready for a signature.

ARTICLES WANTED

Having recently spent about half a kilobuck to attend a symposium on modern typesetting techniques, only to see the whole thing centered around punched paper tape, which even I know to be antique . . . I got to thinking that there have been all too few articles in 73 on using audio cassettes for RTTY applications instead of paper tape.

Hell's bells, we were using paper tape for RTTY back when I first got involved, way back in prehistory (1948) and it was old then, dating back to the twenties or before. I think some of the tape gear I used was well over twenty years old at the time. So here we are in 1975 and they are still using punched paper tape! Lordy. If you've ever handled that stuff, you'll know why I'm asking (pleading) for some audio cassette articles on replacing punched tape.

I've been reading all I can on computers, as I've mentioned before, and one of the gadgets mentioned as being particularly useful for computer input/output is the Teletype ASR-33, a machine that has a paper tape system built in. The KSR-33 is also mentioned (no paper tape), and that sounds more reasonable to me. Say, where do I get a KSR-33? Anyone have any info on that? Oh, sure, from Teletype for a kilobuck – no, I don't want to hear about that.

One of the many terms I've had to come to terms with while trying to defuzz my brain to enter the world of computers is modem. Any RTTYer knows immediately about this, since it's a gadget to take a TT signal and turn it into audio tones which can be sent over a pair of wires . . . and also reverse the process. We call them AFSK terminal units or even more simply, converters. We've been building them for years. As a matter of fact, all of the early RTTY work was done with audio frequency shift keying (AFSK) up on two meters, since frequency shift keying was not permitted on the low bands. That took several years of fighting the ARRL to accomplish . . . ask W6NRM, one of the fighting pioneers, about that battle.

So how about it you computer folk and RTTYers . . . let's have some of your audio cassette circuits so we can put our paper tape gear into glass display cases and admire it.

While there isn't much trouble when dealing with the old slow speed Teletype systems . . . 60 words per minute . . . when you get into the faster machines and into ASCII (eight bit instead of five) (pronounced ass-tea), you can get lousy results when faced with run of the mill tape recorder speed differences. Oddly enough, the fact is that a great many cassette recorders vary quite a bit in speed. We noticed this when we got into making Morse code tapes and found that some would be as much as a word or two faster per minute when played back on some recorders . . . and the same amount slower on others. Well, that is more than you can get away with in RTTY, so some solutions to the problem are in order.

One possible way to handle the trouble would be to use the two stereo channels on the tape, one for the message and the other for the clock. Just thought I'd mention it.

. . . W2NSD/1

GRR GRRREEN

I've made an absolute itch of myself down through the years fighting rules which prevent us from exploring and inventing new techniques and modes of communications.

It is about time for a basic change in FCC attitude toward amateur radio. The whole attitude seems to be one of repression and restriction . . . of making rules to keep amateurs from causing trouble . . . of stopping them from experimentation and development.

The purpose of the amateur rules is most explicit as I wrote in April . . . it says (97.1c) that the purpose of the rules is the "encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the art."

By any stretch of the imagination are rules which prohibit experimentation and pioneering consistent with that mandate? I've made an absolute itch of myself down through the years fighting rules which prevent us from exploring and inventing new techniques and modes of communications. I started out with a big battle back in 1950 to get permission to use frequency shift keying on the amateur bands below two meters. The ARRL put up one hell of a fight to try and stop this, and the FCC dragged its heels for many years. Eventually we made it, and the result has been an orgy of development of circuits which have been taken over by the commercial companies.

One of the major obstacles in the path of development of narrow band FM on the high frequencies was the FCC resistance to permitting it to be used in all of the phone bands. If the FCC had permitted free development of this mode it might have been a different story, with NBFM detectors built into commercial receivers. As it is, this mode won out on the VHF bands and has replaced AM there. NBFM was a ham invention, by the way.

Why is it that amateur rules are so prohibitive? Why is it necessary to get some sort of special permission from Washington before a new idea can be tried out? How many good inventions have been stifled as a result of this restrictive policy?

When you look at the record of what amateur radio has accomplished, even with these rules, the rationale for the rules is even more difficult to understand.

W2BFD put up one of the very first ham repeaters along in 1949 . . . we all wept in frustration when the FCC put it off the air.

There is good reason to believe that VHF repeaters might have been developed by amateurs at least twenty five years earlier if the FCC hadn't been so repressive and shut down early experimental repeaters. W2BFD put up one of the very first ham repeaters along in 1949 on the top of the Municipal Building in Manhattan and it provided RTTY communications over all of Greater New York for many months before the FCC forced it to shut down. I helped John put it up and was one of the active users . . . we all wept in frustration when the FCC put it off the air.

Now there is a request for rule making to permit ASCII code to be used on the air and the FCC is dragging its heels again. What possible justification is there for the FCC to clog the wheels of progress so consistently?

PARKINSON LIVES

The Parkinson concept of more and more government administrators working hard to keep up with the proliferation of regulations they issue is certainly embodied in the FCC Amateur Division.

One of the big moves in this field was the growth from three classes of ham ticket in 1950 (really only two, Class A and B, with Class C the same as B) to six. This called for a lot more administration of the department — more staff — and a whole lot more work. There is little indication that any benefit ever accrued to the governed — certainly the substantial change in the growth pattern which this was supposed to promote never really materialized.

Docket 20282 seems to represent another step forward in unneeded and restrictive control which will result inevitably in more people in Washington to manage the amateurs and help slow down pioneering and invention.

The next biggie was the repeater regulations. This was a beaut and involved the Amateur Division in a fantastic flurry of bureaucratic endeavor — all to no observable benefit to amateurs. Repeaters were on the air and doing fine with little problem — now, two years later, repeater growth and operation is again growing and everything is about the same except for several tons of paperwork and an almost infinite amount of frustration and resentment with the FCC Amateur Division — and God knows how many tens of thousands of dollars in totally unnecessary phone calls.

Docket 20282 seems to represent another step forward in unneeded and restrictive control which will result inevitably in more people in Washington to manage the amateurs and help slow down pioneering and invention. Callsigns which indicate every one of the proposed sixteen different classes of ham license should delight the FCC at all levels — the added people needed to issue and process the many different types of licenses — the people involved in monitoring and keeping the sixteen classes separated from each other on the bands — this might well double the department!

Hail Parkinson. Readers not familiar with the only slightly tongue in cheek books by Parkinson are encouraged to plan some browsing time in their local paperback emporium and bone up on some basic mechanisms for governmental (and industry) growth.

USE IT OR LOSE IT — BALONEY!

That's right . . . horseradish on that old saw. And that is despite the fact that I admit to having been a willing sucker in promoting the concept.

One worry we hear a lot from ARRL is over the possible loss of our bands through lack of use. I hear this

from the FCC too, which only proves to me that they are no more reliable than the League as far as putting amateur radio into any realistic perspective. I guess that leaves just you and me . . . and I'm not too sure about *you*.

I'll lay it right on the line . . . I think that amateur radio has every right to the permanent use of all of the UHF bands alotted, whether we use them or not at any one particular time.

None of us is so encrusted with conservatism that we think for one minute that amateurs are not going to come up with some new ideas . . . new types of communication . . . new techniques . . . new inventions. Amateurs always have done this, despite the bitter reaction against it by old timers within our ranks who have been dragged screaming and kicking along from spark to CW, from AM to sideband, and even into NBFM. We know that new ideas will be along, though we may be determined to fight them.

Just because hams aren't using a band fully at any particular time doesn't mean that the long range good for everyone doesn't lie in preserving the band for future developments.

So there we were in the late 60's with a few thousand Techs trapped up on two meters, making do the best they could with Goonie Boxes and Heathkit Lunchboxes. A bunch more

were living it up on six meters, waiting out the damp nights for the occasional band openings. Above 146 MHz there was this virtually unused land with a couple of wide band FM guys doing something . . . we couldn't make copy with our AM receivers. CB manufacturers were beginning to nudge the FCC, asking how come all that two megs of blank space which could just as easily be filled with jolly chatting CBers? Think of the megabucks!

It turned out that those chaps on FM were onto something . . . they were inventing the ham two meter FM repeater. The vacuum above 146 MHz sucked just about everyone out of the low end of two and all of six meters, leaving some embarrassing empty bands. And, while hams weren't first with repeaters, it didn't take long before they were leading the commercial boys in sophisticated designs and in showing the world what repeaters could do.

The basic moral is this . . . just because hams aren't using a band fully at any particular time doesn't mean that the long range good for everyone doesn't lie in preserving the band for future developments. It is awfully difficult for manufacturers to put off financial gratification – they want to make money right now and if this means getting a ham band away from politically naive hams, well, that's business.

But the fact is that hams, despite their incredible record of inventing and pioneering most of the communications systems we have today, have only scratched the surface. We see hints of some things that could come . . . the growing number of low cost microprocessor chips is opening many areas for development. We'll be able to get voice channels down in several ways with computer processing, permitting phone contacts on bandwidths not much wider than CW requires . . . and watch for multiplexing – a lot more development in narrow band television – slow scan applications, etc.

All these things and more will be along, if we have the bands to accommodate them. We and the FCC (and the ARRL) should remember that once we have lost a band there is no hope of ever getting it back. Our loss of virtually all satellite UHF bands was without a doubt the worst disaster in the history of the hobby, even if it is not yet recognized by many amateurs. This loss was all the worse because it was avoidable and happened only because we made

I notice that despite the value of the land and the need for building space, that Central Park is still around. Well, let's keep the developers out of our ham bands.

almost no effort to prevent the loss. We stood by helplessly, doing absolutely nothing, and got shafted.

The "use it or lose it" concept is destructive. It aids our enemies – the *manufacturers who want to sell equipment and nothing more* – in that it gives them a good excuse to ask for presently unused ham bands. Why is it that we are able to conserve our forests and park areas in good conscience without demanding full use to keep exploiters from building housing developments, and yet we don't have this concept for our amateur bands? I notice that despite the value of the land and the need for building space, that Central Park is still around. Well, let's keep the developers out of our ham bands.

PERSONAL FULFILLMENT

Do you ever feel that sort of nagging need to leave the world a little further ahead than it was when you arrived? This is the need that rag chewing, watching television, and keeping up with baseball won't placate.

It is elusive . . . it has something to do with leaving a mark on the world other than a headstone. Not everyone can produce Nobel Prize research, or invent narrow band FM, but that is no reason to just give up and settle for being a cypher in the statistic books. The fact is that there is a lot of research and inventing that you could do if you could get yourself off dead center. It doesn't take a master's degree to plow new and exciting ground. It doesn't even take massive intellect. The prime ingredients are interest and persistence . . . they will win out over just about anything.

Outside of the radio field there are an unlimited number of areas for investigation that beg for answers. A new book out in paperback (Bantam Y8368) Supernature by Lyall Watson ($1.95) should be quite inspirational. This should fill you so full of ideas and questions that you will have a difficult time deciding where to get started.

In amateur radio there are many areas for progress. One relatively simple one which is about ready for development is multiplexing for ama-

teurs. This might be a gigantic step forward for us since it could do two things at once . . . firstly it would permit us to use each shortwave frequency for several contacts without interference. And perhaps even more important, it would allow us to get started with duplex contacts where, like the telephone, either party can talk at any time and be heard. This could have a profound effect as the strictly one-way talking limitation is a much heavier burden on amateur radio than is generally recognized.

While I don't know much about it, it appears to me that by use of some outside standard such as the color burst frequency or, better, the UHF location signals, we could set up multiplexing on any band . . . say 20 meters . . . and have a six way duplex contact all on one frequency. What a way for a round table! We haven't had that type of communication in amateur radio since the old days on 160 meters before a few chaps got over zealous with playing phonograph records and "broadcasting" was prohibited. Later, they got to looking at the rule they had passed and discovered that it also prohibited duplex . . . well, that's the way it goes when you mess with the FCC, you lose ten times what you expect. I wonder if any of the fellows are still alive that insisted that the FCC outlaw broadcasting back in 1938 . . . probably not. Their heritage is with us . . . hopefully not too many present day amateurs will push the FCC for changes which will leave such a heritage for future hams.

The few remnants of the old days will tell you, wistfully, how great 160 meters and those fantastic duplex round tables used to be. You can actually talk with people that way instead of lecturing them and then falling asleep while they ramble on . . . and on.

Multiplexing could solve the repeater problem too . . . at least for a while. If we could get six or eight simultaneous contacts through repeaters we could not only work duplex, but we'd be able to talk at length again and not worry about timing out . . . providing we could ever get the FCC rules forcing repeaters to have timers changed. Outmoded rules have a way of living on.

There are many other areas for amateur invention and pioneering . . . just keep your eyes and mind open.

IT TAKES MONEY

No, it doesn't. The fact is that you can generally find a way to get the things done that interest you . . . including getting money for them. Most research can be done very inexpensively and money for it shouldn't be much of a problem.

There are so many ways open for making money that it seems ridiculous for anyone to be seriously in need of it. I mentioned a couple of years ago that hams have a natural in with such electronic developments as security and burglar alarm systems. Several amateurs took the cue from that and started in the business in their spare time, building up from nothing to where they were working full time and had several employees.

There are ideas everywhere. A few days ago I visited Tufts Radio, probably the biggest ham dealer in New England today . . . Chuck Martin WA1KPS, the owner, went out with Virginia and me to dinner and then decided to get an ice cream cone . . . Chuck mentioned a place nearby with famous ice cream . . . sure enough, we had to wait over a half hour in line for it . . . and this was during the week! We had fun while on line with HTs and the time quickly passed, but it did not escape me that here was a business that anyone could get started and which would be very successful. They make ice cream the old fashioned way . . . with cream, real flavors, and a big motor cranked freezer right out in plain sight. They didn't have many flavors, but they made their own hot fudge from butter and chocolate, and their own whipped cream from real cream and real vanilla flavor.

Another one which I haven't seen anywhere in this country . . . Syrian ice cream! Syrian bread is all over the place now, so how about their ice cream? It's easy to make and totally different . . . and should sell like crazy. If you start up and franchise it how about a ten percent fee for my idea? I've never seen it anywhere else in the world, not even in the neighboring countries.

There is still plenty of room in the ham business for new companies. Most of the present companies started in cellars and grew out of spare time gambles. It takes a lot of time, but it sure is nice to have your own company . . . beats working for a living . . . if you don't figure hamming as work.

COMING COMPUTER REVOLUTION

The development of the microprocessor IC such as the Intel 8008 and 8080, the Motorola 6800, and such ilk has created a wave of change which may eventually destroy the present balance of power in the computer field. Oddly enough, amateurs are in a very good position to benefit from this revolution.

As you no doubt know, IBM got in there early and by virtue of their designing and marketing expertise have been able to control the major part of the market. A few other firms are in there pitching, but IBM is the biggy. Digital Equipment Corporation is large by any other standards except comparison to IBM . . . and then comes a lot of other much smaller companies.

IBM stayed on top by being smart enough to call the turn of the cards on equipment developments. They got started with tube computers and were one of the first to go transistor . . . and again first with ICs. Put together with their very effective sales force and service, with very little serious competition, IBM did fine.

Normally I don't buy the Scientific American magazine . . . mostly as a way to save my own time. I used to subscribe and found that I was reading the darned thing from cover to cover, fascinated by the articles . . . but then a few weeks later the details would start to slip from my memory unless I looked over the articles again or discussed them with someone . . . something like being familiar with a foreign language . . . you gradually forget more and more unless you keep it fresh. I decided it was better to just skip the whole thing and not read the articles in the first place.

Anyway, the May issue has an IC on the cover so I broke loose with the $1.25 and bought it. The thrust of the article is that things are moving faster and faster in computer IC design. A computer that took three big circuit boards covered with ICs last year is now on one small board this year, or even a 2" chip!

Since we're looking around for an in-house computer for 73, I think of these developments in terms of the cost of computer systems to a businessman. And since I'm also getting more and more into playing with these things as a hobby, I think in terms of hobby applications and home or family uses.

A computer system consists of three major parts — the input/output unit such as a Teletype machine, a video terminal with a keyboard, or perhaps a line printer — a central processing unit (CPU) — and some sort of memory. Memories can be on discs, floppy discs, cassettes, ICs, or on reel to reel tape.

Now, while there are advancements in all phases of computer hardware, the CPUs seem to be progressing fastest. The new ICs have to drop the CPU cost substantially . . . as witness the MITS Altair 8800 unit at $621 assembled and working. I immediately got in line for one of these and am busy trying to figure out how it works and what I can hook up to it. Motorola was making a big deal out of their 6800 Chip at Dayton, so we can expect some microprocessors using that soon, also in the low price range. All this has got to have an impact on IBM, Digital Equipment (DEC) and the other big computer firms.

What I see ahead, and not too far off, is these large companies scrambling to keep up with designing and manufacturing hardware and the sales of computer systems going to smaller local companies who can plan, install, program and service systems tailored to local businesses. They will use one make of CPU, another VDT (video display terminal), another brand of printer, and perhaps someone else's memory units. This might evolve something along the line of two-way radio sales and service shops.

There will be plenty of room for new and small companies to design and make hardware. MITS is very small, yet look at the impact they have had in the business already! Southwest Technical is another small outfit, yet their new terminal kit, which will mate with many of the surplus ($20-$40) ASCII output keyboards and any TV set to make your own VDT, is a smash success. This can simply be connected to the Altair 8800 and you are beginning to have something in the way of a real toy to play with. A little extra memory (maybe the Godbout chips which give you 1024 bytes for S39.50) is needed . . . or perhaps someone will get hot with a discount priced floppy disc drive system.

Applications? Just with stuff available now you can set up a good sized mailing list and print out labels . . . keep track of every LP record in your collection . . . or even every selection . . . every book in your library . . . articles in back issues of magazines . . . movie reviews . . . your checkbook . . . who you've worked and whether they've QSLed . . . all the repeaters . . . your junkbox inventory . . . etc. You can store this stuff on cassettes for long term memory using the serial output interfaces (uart) ($40 from SWT — or build it from an article in 73).

Much of the older computer hardware is turning up in surplus houses or junk shops and a saddening thing is that many of the proprietors have no idea what they are hacking up and selling for junk metal . . . such as perfectly good keyboards, disc memory units (make great cocktail tables), page printers (nice motor in there, mac), keyboard to video display IC boards (lotta ICs on there, but we don't get none of them resistors on the boards like we used to).

The big companies had things their own way while they were selling high cost systems to bit companies, but now that computers are getting down to thousands of dollars instead of tens or hundreds of thousands, I think things will change and I expect the entrepreneur to be the one to benefit . . . and this could well be you, since you know enough about electronics to get into this new field. Oh, you'll have to start reading the articles carefully, do some building and playing around, and maybe crack some books. You'll have to get together with the computer types on the local repeater (and there are plenty of them in many areas) and get to be able to decipher the odd language computer folk have devised to keep their conversations and publications relatively private.

One dividend of the air of secrecy computer folk have generated is that very few of the people in the field have competency in more than a very narrow segment of computers. Some are real hot on programming (software, they call it) — some are zingers at hardware (nothing to it, they say) — some have an understanding of the applications of the equipment — darned few are into all three. And, since most of the computer people have been tied to one company, there is nowhere near as much general knowledge of what is available as there should be. IBM people tend to really believe that there really is nothing else much worthwhile to even consider, certainly not worth spending time understanding. DEC people have heard of the IBM gear, but don't seem too sure about that dark age stuff. Thus there is another opportunity for the amateur to step in and get to know the field . . . and become the expert . . . the consultant.

We're still trying to sort out all the info we can get as far as automating 73 is concerned. We need a few VDTs for data entry and output to make subscription changes, bill advertisers, credit them, bill for subscriptions, and things like that. It should also keep the repeater atlas and print it out for each new edition. It should handle reader's service requests. We need a 132 line page printer (rather fast so it can print out the mailing list in at most one day) . . . probably from Centronics over in Hudson NH. The most difficult matter is a memory unit capable of having the entire mailing list available . . . that would take about 8 million bytes, so we may have to break that up into smaller bites (those are eight bit bytes) and work on part of the list at one time. Anyone with good ideas on how to do that — cheap?

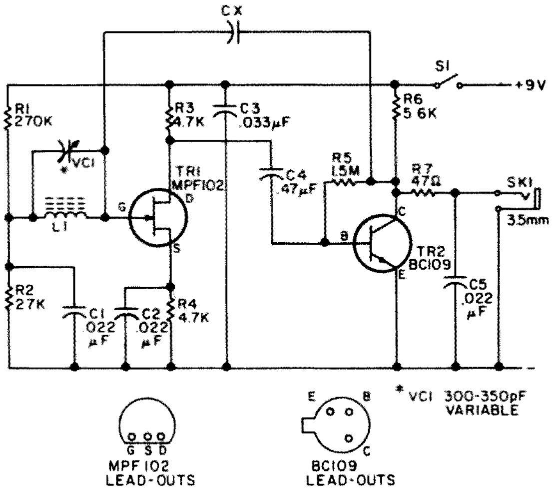
FIENDISH IDEAS

The June Esquire arrived . . . dreary magazine . . . but it did have a couple of moments for me such as one about cutting your own hair . . . I've been doing that for almost ten years . . . ever since hair cut prices went to over $1.50 and it got cheaper to buy scissors. Sears has a pair that does the job . . . one for cutting and the other for thinning. Every few weeks I clip off the hair which is creeping down toward my collar and trim around the ears. Then I thin away fiercely and it comes out fine. The whole operation takes maybe about ten minutes every few weeks . . a far cry from those long waits at the barber shop of my youth . . . and the worn old issues of magazines.

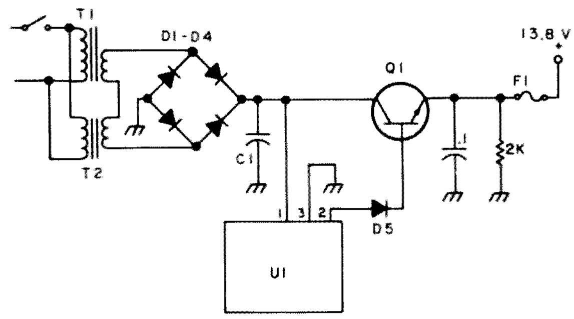
Esquire also had an article on celebrity shaving . . . none of 'em know what they're doing. I lucked on the ideal shaving system over thirty years ago . . . in the shower using an injector razor . . . I like the twin blades now and rarely come out bleeding. The hot water softens the skin beautifully and makes an absolutely painless shave . . . all the while the stream of the shower is generating ions by splashing off your back, helping your brain to think more clearly (many of my most fiendish ideas come to me in the shower) and making you feel better in general.

. . . WAYNE

CIRCUITS, CIRCUITS, CIRCUITS.



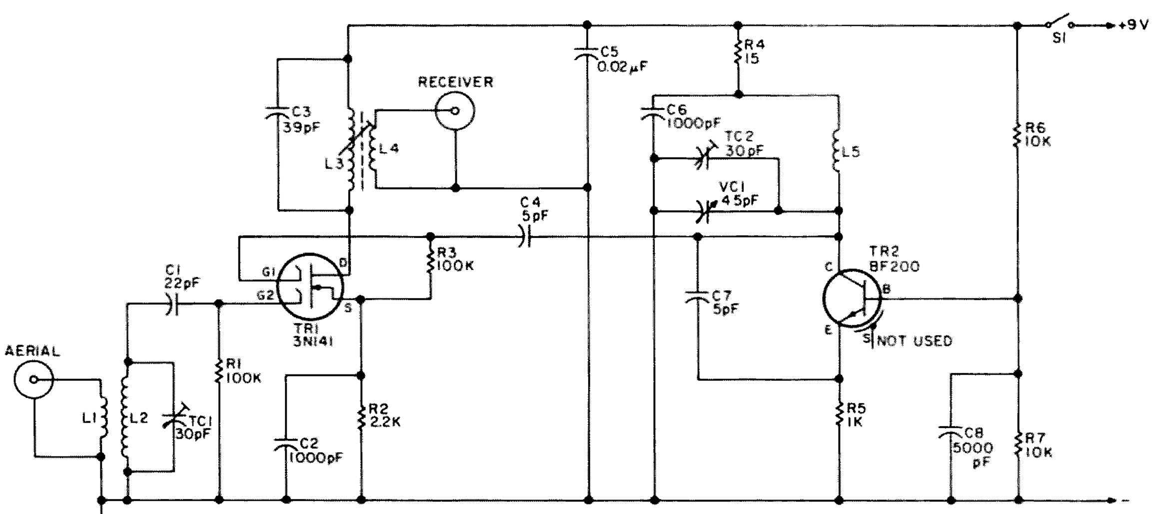
Two transistor receiver. All resistors ¼ Watt 10%. L1 – aerial tuned winding on 3½" x 5/16" diameter ferrite rod. S1 – slide switch. Also needed: 9 V battery, type PP3 (Ever Ready); battery connector; crystal earphone with 3.5mm jack plug; knob; case; materials for printed circuit board. (From Radio and Electronics Constructor, February, 1975)



Simple power supply for 2m FM rigs (thanks W3HUC).

T1	12.6V 3A
T2	6.3V 3A
D1 – D4	3A 50 PIV
C1	2000μF 35V
U1	μA 7815 *
D5	1A 50PIV
Q1	2N3055*
F1	4 amp fuse

*Semi-conductors available from Circuit Specialists Co., P.O. Box 3047, Scottsdale AZ 85257.



Two transistors are the basis for this tunable converter. L1 – 2T #22 swg wire, wound at ¼" diameter; L2 – 5T, same as L1; L3 – 21T #24 swg enameled closewound; L4 – 4T insulated connecting wire wound on L3; L5 – 1¾T. (From Practical Wireless, March, 1975)

73 reader service

Check appropriate boxes for desired company brochures, data sheets or catalogs and mail in to 73. Include your zip code, please. Send money directly to advertisers. **LIMIT: 25 requests.**

ADVERTISER INDEX

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Reader's Service JULY 1975
73 Inc., Peterborough NH 03458
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Name ________________ Call ________

Address ________________

City ________________

State ________________ Zip ________

Coupon expires in 60 days . . .

PROPAGATION CHART

J.H. Nelson

Good (open) Poor (0)
Fair (□) VHF/DX (▩)

July — 1975

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	$\boxed{2}$	3	$\boxed{4}$	$\boxed{5}$
6	7	8	9	10	11	$\boxed{12}$
$\boxed{13}$	$\boxed{14}$	15	16	17	18	19
20	21	22	23	$\boxed{24}$	$\boxed{25}$	$\boxed{26}$
27	28	29	$\boxed{30}$	$\boxed{31}$		

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7	14	7	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	7A	7	7	7	7A	14	14	14	14	14
AUSTRALIA	14	14	14B	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7A	14	14	14	14	14
HAWAII	14	14	7	7	7	7	7	7	7	7A	14	14
INDIA	7	7	7B	7B	7B	7B	7	7	7	14	14	14
JAPAN	14	14	7	7	7	7	7	7	7	7	7	14
MEXICO	14	14	7	7	7	7	7	7	7	14	14	14
PHILIPPINES	14	14	7	7B	7B	7B	7B	7	7	7	7	7A
PUERTO RICO	14	7	7	7	7	7	7	7	7A	14	14	14
SOUTH AFRICA	7	7	3A	7	7	14	14	14	14	14	7	7
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14	14
WEST COAST	14	14	7A	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7A	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	7A	7	7	7	7A	14	14	14	14	14
AUSTRALIA	14	14	14	14B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7	7	7	7A	14	14
HAWAII	14	14	7A	7	7	7	7	7	7A	14	14	14
INDIA	14	7	7B	7B	7B	7B	7	7	7	7	7	7A
JAPAN	14	14	14	7	7	7	7	7	7	7	7	14
MEXICO	14	7	7	7	7	7	7	7	7	7	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7	7A
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	14	14	14	14	7	7
U. S. S. R.	7	7	7	7	7	7	7	7	7	7A	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7A	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	7A	7	7	7	7	7A	14	14	14	14
AUSTRALIA	14	14	14A	14	7A	7	7	7	7	7	14	14
CANAL ZONE	14	14	7A	7	7	7	7	14	14	14	14	14
ENGLAND	7A	7	7	7	7	7	7	7	7	7A	7A	14
HAWAII	14	14	14	14	7A	7	7	7	7	14	14	14
INDIA	14	14	14	7B	7B	7B	7	7	7	7	7	7A
JAPAN	14	14	14	7A	7	7	7	7	7	7	14	14
MEXICO	14	14	7A	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7A	7	7	7	7	7	14B	14B	14
PUERTO RICO	14	14	7A	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	7B	7A	14	14	7	7
U. S. S. R.	7	7	7	7	7	7	7	7	7	7A	7A	7
EAST COAST	14	14	7A	7	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 amateur radio

AUGUST 1975
ONE DOLLAR

Helical Antennas

OPTIONAL THIRD GENERATION FLEXIBILITY

SWR Computer

BALANCED RECIPROCAL CAPABILITY

TTL Logic

INTEGRATED TRANSITIONAL OPTIONS

Wx Satellite Monitor

FUNCTIONAL INCREMENTAL CONCEPT

73 amateur radio

#179 AUGUST 1975

COVER: The notorious Oscar Zapper, by Alan Bridges WB4VXP. Article begins on page 12.

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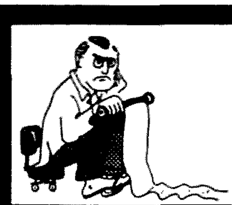


NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

BYTE MAGAZINE

The response to computer-type articles in 73 has been so enthusiastic that we here in Peterborough got carried away. I found myself enormously interested in the rapidly evolving microcomputer field and started subscribing to many of the small newsletters in the field. The more I read the more enthusiastic I got . . . and on May 25th we made a deal with the publisher of a small (400 circulation) computer hobby magazine to take over as editor of a new publication which would start in August . . . BYTE.

We figured we could print the first issues on our own small offset presses as the magazine gathered steam. We might run 5000 copies of a 24 page magazine for starters. Within a couple of days, with the telephone ringing constantly, we knew we had underestimated the thing . . . it would take a 10,000 run of 48 pages to meet the interest. A week later we were up to 96 pages and a 35,000 press run, far beyond our small print shop facilities

How come all the enthusiasm? Well, it appears that just about everyone who is in any way involved with computers has a very deep need to have one for himself. You can get a nice little computer working for under $500 and use it for a wide range of applications. You can hook in cassette recorders, television typewriters, and teletypewriters. All kinds of goodies are available surplus. The applications are myriad . . . some are using their systems to aim antennas for Oscar or moonbounce, some for keeping track of their music or book libraries, some to index ham articles, some to automatically print weather satellite pictures, some to automate RTTY stations, some to run their home security systems, and almost all to play a wide range of games.

Calls come in daily with more uses . . . one chap has a program to look for key words in any text and set your printer going when matter comes up of interest. Suppose you tune in the RTTY broadcasts of the Congressional Record every day and scan it for the words "amateur radio." Others are working out ways to make use of the one minute phone rates for a maximum exchange of information, computer to computer. Remember that there is no charge if your computer is called and tells the calling computer that it has nothing for it . . . or if the exchange is under a second or two. Many of the commercial computer systems use this aspect of the phone system . . . polling dozens or even hundreds of computers through the night and only interconnecting (with a phone charge) where there is traffic to be passed.

Most of the top writers in the field have leaped to help get BYTE going in good style and articles are pouring in . . . lots of information on the presently available microcomputers such as the Altair 8800, the Scelbi 8B, RGS 008A, etc. BYTE will cover interconnecting to these units, peripherals, interfaces, the circuits and construction plans for building your own CPUs, news of all user clubs, news of programs available and how to get them, news of all specialized publications, explanations of all computer terms and how the various computer programming systems work.

In no time at all you'll be throwing around computer buzz words such as loader, compiler, assembler, basic, Dibol, Cobol, machine language, byte, bit, word, flag, and so forth.

Computers will be adding a whole new dimension to amateur radio . . . you wait and see. Right now you have the choice of getting in at the

beginning of a fantastic new hobby or waiting and trying to catch up later on. First issues of BYTE will be as rare as early issues of 73 . . . you'll see.

BYTE will be $1.50 per copy, subscription $12 per year, and a Charter Subscription is only $10. BYTE, Peterborough NH 03458.

MORE BAD NEWS FOR OTs

The "W" clan are in for another massive trauma which may regress them even further into the old spark days. After a good solid ten years of having to read about transistors and five years of rapid strides in IC technology, many old timers are still shaking their heads and waiting for the return of the tube. Fellows, you might as well start cracking the books because you can't even pass a ham exam anymore without solid state savvy.

And what is coming up . . . rapidly . . . is a whole new technology that we are all going to have to accommodate, whether we like it or not. It's them ICs what done it to us. When I was a youngster I used to wonder why they didn't make microcircuits . . . now I see why . . . the whole thing has gotten completely out of hand and is taking over . . . they never should have started. Massive monolithic integration . . . microputianism gone berserk.

You've undoubtedly seen the RGS ads for the 8008 microcomputer kit . . . the MITS Altair 8800 microcomputer kit . . . the Southwest Technical keyboard visual display kit . . . so you probably sense on some level that computers are beginning to creep into your world. What you may not realize is that you are going to have to adjust to them and learn to talk the language . . . and think it.

If you are shifting around uncomfortably, thinking that well, shucks, sure . . . you can bone up on digital stuff and get it straight about those damned nand and eitheror gates, you are in for a ghastly awakening. They are building thousands of transistors into those ICs these days and what has developed is a whole new approach to dealing with the situation. It's called programming . . . or software, if you prefer the computerese buzzword. This is the system by which you can get these incredibly complex little black boxes with those funny centipede legs to do something useful for us.

Software. This can be the throwing of a bunch of switches to feed the instructions to the circuits . . . or it can be typing on a Teletype keyboard . . . or data from a tape cassette . . . or punched tape . . . etc. There are a raft of "languages" used to put the instructions into computers . . . basic, machine, fortrans, cobalt, diabolic, assembly, and others . . . many others. You are going to be learning some of these languages. The chances are that you will eventually get familiar enough with them to actually understand what you are talking about.

Is it worth all the work? No question about it . . . if you are one of those who is the first in his block to get new things you'll be eating up the articles on software systems as they come out . . . if you are the guy who never gets the word you'll be missing out on more fun than you can imagine. The new microprocessor chips are opening up a fantastic (and complicated) world for us.

The prices on this stuff will be much like those of hand calculators and digital watches . . . relatively high at first and then dropping rapidly as more and more people find out where the action is and volume picks up. I remember all the resistance I ran into in 1948 when I wanted to buy a television set . . . they were very expensive . . . about $750 for a 10" black and white set by today's dollarette standards . . . turned out to be one of the best investments I could have made . . . years of entertainment . . . and I got to see all those fantastic early programs you missed. I bought one of the first transistor radios too . . . a Regency . . . expensive . . . and I never regretted it. You can miss a lot of fun waiting for that price to drop.

We'll try to do the best we can on getting articles for you . . . if you have an article of value lurking in the back of your mind, get busy and write it up.

WANTED

We're getting up to here in old files and would like to start microfilming the stuff. On the odd chance that some reader has a microfilm or microfiche camera, film processor and reader system available . . . hopefully at a bargain . . . this notice is given.

We're needing some cassette duplicators too, if there are any of those flying around that are not badly needed.

Another need: IBM Selectric II typewriters . . . used. Also we could use a couple of Teletypes with forms feeders.

. . . W2NSD/1

HOTLINE HEADLINES

Pacific Telephone brings national spotlight to 73 Magazine with suit over circuits in June issue. Other ham publishers furious over PR coup. Citing the circuits in the Inside Ma Bell series in 73, PTT brought suit for $100,000. Dealers immediately ran out of counter copies of this issue and subscriptions were up substantially.

Emergency Beacon Canceled. All further advertising in 73 Magazine has been canceled by the publisher until some problems with meeting specs and customer relations have been resolved.

QST board votes unanimously to increase size of the magazine to about that of Radio Electronics — members not consulted in this major decision — no benefits to members likely. Increased size will make for many problems, few economies. Other ham magazines will certainly be forced to follow QST in size change. This appears to be change for the sake of change.

RFI bill introduced in congress — HR7052 will regulate susceptibility of home entertainment devices to radio interference. Get your congressmen to push this one.

Saroc Hawaii convention disappointing. Commercial "convention" for profit run by defrocked ham attracts few despite allure of Hawaii and strong backing of one ham magazine.

Rochester hamfest a winner this year. Attendance estimated at 3500 — money was a bit tight according to exhibitors — possibly due to cash drainage at Dayton a few weeks earlier.

California fights Bell — prohibits steep rates for insignificant bits of hardware such as answering machine and phone patch couplers.

ARRL breaks $2 million in 1974. Despite reported loss for the year (a small one), cash and stocks are now totalling nearly a million dollars, building up steadily. When is a loss not a loss, IRS?

Wichita Amateur Radio Club has the most outstanding comment filed on docket 20282 — reprinted in entirety in Hotline #31. Goes right to the heart of the matter and lays it on the line.

SSTV contest winner: WB4ECE. Runners up — WA1NXR, W9NTP, WB9LVI and G3IAD.

BE MY GUEST

Visiting views from around the globe.

HOW TO GENERATE YOUR OWN INTERFERENCE

In the past year, WR2ABU has been plagued with incidents of malicious interference, illegal stations with obscene "traffic" and other harassments. Dick's phone has been ringing off the wall with members demanding that "The Club" do something about it. Well, the Club did. An unnamed Committee was established with the purpose of tracking down the offenders. It was unnamed because we were well advised to keep the Committee's activities, methods and identities a secret.

The Committee's investigations produced results in an amazingly short time. In several instances surveillance cars monitored illegal transmissions from right next door to the offending source. Names and addresses were obtained. Every new call on the air was investigated via FCC files.

It is not the purpose of this article to talk about the Committee, however.

Most of the offenders turned out to be part of a "hate ham radio group" consisting of a group of Citizen's band operators. Although the evidence was overwhelming, I couldn't help but wonder why they would hate us. What do they have against amateurs? Since their interests so closely parallel ours does it not follow that every CB operator is an aspiring amateur operator.

For me the answer was not long in coming. All I had to do was listen to the repeater for a couple of days. Whenever something bad comes up the speaker blames it on "those CBers". When something derogatory about an operator is called for (?) he is called a CBer. CBers are ridiculed, scorned, taunted and verbally abused in every conversation they are discussed.

In short, gentlemen, WE ASKED FOR IT! I'm not sympathetic in any way with those who would for any reason deliberately and maliciously cause interference to communications, but I believe it is time for us to administer a cure.

First, our attitude towards CB must change. Sure, the 11 meter operations leave a lot to be desired. Yes, there are many poorly qualified CB operators and much of the worst we think about CBers is true of *some* of them. But how do you feel when someone makes a derisive remark about ham radio, citing the actions of a ham that you don't like any better than he does? What we are doing is blaming ALL CBers for their ills. Aren't they people, each with an individual personality? Is it fair to generalize and say that anyone who holds a CB license is all bad? If so, we better start weeding out those in our own ranks because many hams also hold CB licenses.

And why not? CB has a legitimate intent, just as amateur radio does. If all radio services were to be discontinued due to abuse all you would hear on a radio is static.

Stop for a moment and consider the relationship between ham radio and CB. Before the Citizen's Band service was established, a person with an interest in radio had two choices: listen only, becoming an SWL; or study and work toward an amateur license. SWLs were never the object of ridicule or slander by hams. They were considered potential hams and were treated with friendliness and encouragement. Classes were held by ham clubs to help them obtain licenses. This process continues today, but haven't you noticed that there are fewer SWLs lately? Has it escaped your notice that the average age of members of ham clubs is increasing?

Acting Professional

Some of the largest problems the SCRA elected officers and appointed officials have had to contend with over the past three years have come from within the ranks of our own membership. The systems whose idea of support is to agree with you only as long as you agree with them; those systems who wave their flag of SCRA membership as though it gave them divine right to do as they please; those systems who bend and twist every word in an effort to subvert the very job the SCRA was created to do; those systems who scream *interference* if, by pointing their yagis at *exactly* 127°37', a new co-channel user breaks their squelch; those systems who cry *foul* if the SCRA dares to propose an adjacent-channel system within 800 miles of them; those systems who hang up on you when you call to tell them their "local" machine is devastating 25,000 square miles. Until you've actually been there, you wouldn't believe it! If you ask them about it, they tell you to go pick on somebody else, after all, as members of the SCRA, we should be helping and supporting *them*, not harassing them, etc., etc. Maybe it is time the SCRA reassessed its values since some of its members appear to have lost theirs. To be supported, you must support; to be helped, you must help; to be an Amateur, you must act professional. Should this trend continue, it, like a cancer, will doom the SCRA to a slow and painful death. If it does, I, for one, will grieve.

Charles R. Flanagan W6OLD
Chairman, Southern
California Repeater
Association

Look around at your favorite ham club the next meeting you attend. COUNT! How *many* young fellows are there?

What is happening is that there is a third choice available to the young SWL today. The path to a CB license is easy and tempting. Granted, many of the people that take it might not make good hams, but what of those who would? I'll bet most of the people who would have otherwise become good amateur operators are now going into CB. We can't expect to turn the tide from CB because the easier path will always be followed, but there are things we should be doing and most importantly there are things we SHOULDN'T BE doing!

What we should do is to consider CB as the source of new amateur operators. The first stage of filtering from the general public has already taken place — all we have to do is to provide encouragement, incentive and cooperation. Those having sufficient interest to make it will then become amateurs and both will be gainers. We should contact legitimate CB groups and establish understanding with them. We should do what we can to make amateur radio an attainable goal for those willing to work for it. Finally, we should help make them WANT to become qualified amateurs.

What we should NOT do is to use our licenses (and repeaters) as the means for public denunciation of CBers. If they weren't interested in amateur radio, why would they be listening in on the repeater? They should certainly not hear themselves insulted — that only alienates them and causes them to hate amateurs.

Unless we start to face reality soon things will get a lot worse before they get better. Even the best of Committees (such as ours) won't be able to do much good.

Don't make nasty or unfair remarks about CBers on the air. Don't let others doing it stand unchallenged. The only way listening CBers can defend themselves is by kerchunking or transmitting interference. If you say it for them they won't have to. If the subject compels you to make negative statements, change it!

Don't say CBers when you mean LID. If you like to make enemies, the repeater is the place to do it wholesale.

Gilbert Boelke W2EUP

Reprinted from The Link, *Bulletin of the Buffalo Amateur Radio Repeater Assn, Inc., May 1975.*

reading everything

The local QRPer, who was worrying about the DXCC fees a week back, came up the hill again last week.

"You know something," this QRPer said, "I understand that the ARRL has been losing money and that they are going to have to dig it out of somewhere . . . like the DXCC for instance. Did you know that?" We had read this over the years, so we nodded our head, thus preserving our erudite facade. The QRPer smiled at our reply and we should then have been a bit suspicious . . . just a bit.

"You know something," he contined, "I checked back to 1964 and would you believe that every year since 1964 the ARRL has shown an operating loss . . . eleven straight years of deficits?" We nodded again to this, but the QRPer rattled on without waiting for our reply. "And that the total of these eleven years of deficits runs to about $470,000?" And again we nodded, for these are parlous times and many must bear a heavy burden. But the QRPer was smiling again and for sure by then we should have been wary.

"Do you know," the QRPer asked, "that last year they reported an operating loss of $137,547 but they showed an asset increase of $216,546?" Son of a Gun — we were on our feet at this for something was not adding up. "How do you figure that?" we roared, for we were feeling trapped again. "How do you figure they had the assets go up so much when they lost over a hundred thousand?"

The QRPer shrugged. "Don't ask me," he said. "All I know is what I read in the Annual Reports. And since 1964, when the operating loss was over $470,000, the assets increased over a half million. That's all I know." He was saying this, but that beady-eyed smile was just a bit brighter.

We thought this over for a bit. "I hear what you're saying," we said, "but what does all of this mean?"

The QRPer was quick to reply. "It means that we DXers are fortunate to have someone to watch out for our interests," he said, and away he went down the hill.

And vexed and bewildered, we dug out our own Annual ARRL reports. All we can say is that QRPer sure does read everything.

Reprinted from West Coast DX Bulletin, *June 2, 1975.*

Taking Action

If amateur radio operators throughout the nation would follow the example of those in little Union City, Tenn. (population 13,500), they probably would be petitioning the FCC for new frequencies, rather than fearing the loss of some they now have.

During the past few months, mainly through the efforts of Willie Pope K4VDQ, radio classes have been organized and 11 new Novices licensed, while others have upgraded to Advanced.

The story actually began last winter when Mr. Pope returned to the local radio station in Union City after having worked for some years in Orlando, Fla.

While there were a number of hams in Union City, most were going their own merry way and little was being done to teach the art to the younger set. Something had to be done to revive the interest among the youth in amateur radio and Willie proved to be the catalyst.

He rounded up Glen Leggett K4GMQ and Bill Porter WA4PRA, and plans were hastily worked out to conduct a Novice instruction class and to organize the Reelfoot Amateur Radio Club.

Stories were run in the Union City newspaper and aired on the radio station, and between 17 and 18

Continued on page 143

ALABAMA

*WR4ACB	Birmingham	146.76
†WR4ALR	Evergreen	146.76
*WR4AFP	Jasper	146.64
†WR4AEJ	Montgomery	146.64
D–WR4AJH	Montgomery	146.94

CONNECTICUT

D–WR1AAF	Oxford	146.49

INDIANA

†WR9AFL	Indianapolis	443.75
*WR9AFN	Logansport	147.18

IOWA

*WRØAGJ	Cedar Rapids RTTY	146.70
†WRØAIM	Cedar Rapids	147.27
*WRØ	Clinton	146.67
*WRØ	Davenport	223.94
†WRØ	Knoxville	146.64
*WRØAEO	Lamoni	146.73
*WRØ	Ossian	146.85
†WRØADC	Ottumwa	146.97

MAINE

*WR1AEU	Litchfield	146.70

MASSACHUSETTS

D–WR1AEZ	Chestnut Hill	147.55
*WR1AEZ	Newton	146.715
D–WR1AER	Fair Haven	146.655
*WR1AFK	Falmouth	146.85
*WR1AFI	Hyannis	146.94
*WR1ACU	Reading	147.075
*WR1AED	Springfield	146.76
*WR1ABG	Webster	147.345
†*DL2AA/WR1	Medway (previously deleted in error)	147.21

MISSISSIPPI

*WR5AJC	Ackerman	146.73

MONTANA

†WR7AFW	Great Falls	146.88
†WR7AFE	Helena	146.76
*WR7	Judith Gap (Lewistown)	146.76
†WR7AFU	Missoula	146.94

NEW HAMPSHIRE

*WR1ADB	Gorham	146.76

NEW YORK

*WR2AHB	Jamestown	146.79
*WR2AHS	Hornell	146.91

NORTH CAROLINA

*WR4ALC	Asheville	146.64
*WR4ALC	Asheville (52.01)	53.99
†WR4AJX	Fairview (147.24)	147.90
†WR4AHA	Forest City	146.67
†WR4AMB	Greenville	147.09

PENNSYLVANIA

*WR3ACT	Allentown	146.745
*WR3ACM	Altoona	146.82
*WR3ADJ	Berwyn	147.36
*WR3AFF	Clinton	147.21
*WR3AEJ	Corry	147.09
*WR3ADD	Hatfield	147.33
*WR3ACE	Lancaster	146.82
†WR3ADB	Muncy	146.82
*WR3ADU	New Kensington	146.64
*WR3ADC	Pottstown	147.21
*WR3AEP	Rydal	147.30
*WR3ACW	Sunbury	147.30
*WR3AES	Susquehanna	147.24

RHODE ISLAND

*WR1AFA	E. Providence	146.835

SOUTH DAKOTA

D–WRØ	Aberdeen	146.94
†WRØABL	Rapid City	146.94
D–WRØABX	Sioux Falls	146.94
*WRØAHM	Green Mt. (N. Black Hills)	146.76
*WRØAEE	Watertown	146.85

VERMONT

*WR1AFL	Winooski	146.61

VIRGINIA

*WR4ALR	Hampton	146.73
*WR4	Portsmouth	146.85
*WR4AMQ	Roanoke	146.73

WEST VIRGINIA

*WR8ACO	Beckley	146.94
D–WR8	Huntington	146.94
*WR8AGH	Huntington	146.76
*WR8AFE	Huntington	146.85
*WR8AAB	Hinton	146.88
*WR8ADD	Logan	146.97

FOREIGN

HONG KONG

*VS6	Hong Kong (144.48)	145.64

ISRAEL

*4X4	Jerusalem	145.775

MEXICO

*XE2IO	Baja Calif	147.33
*XE2RMX	Mexicali	146.91

PUERTO RICO

*WR4AEC	Adjuntas	146.76

† = CHANGE
D = DELETE
* = ADD

LETTERS

SWEATING IT OUT

Mr. Spenser Whipple, Jr.
c/o 73 Magazine
Peterborough NH 03458

Dear Mr. Whipple,

I have just unglued my eyeballs from your June article on couplers for the third time!

I am sweating it out until you publish your next article where you promised to take up the discussion of telephone couplers for answering machines.

I just inquired of the California Public Utilities Commission about their Interim Order Number 138. This opens up the field of customer designed telephone couplers, if they are approved by a Registered Professional Engineer (EE).

Only two, one fellow out in Chatsworth, California, and myself, sent in an ordinary inquiry letter, and Bang! They put both of us on their approved engineer list! Yeah, just for opening our big mouths and asking for information.

So, I am scrambling around trying to re-build my telephone engineering reference library. I disposed of it nine years ago when I tried to retire, hi! So, all circuits and descriptions of approved types of telephone couplers for telephone answered machines are most welcome.

Again, I am looking forward to your next article.

E. Kenneth Taylor W6WT
Communications Consultant
8528 West Hargis St.
Los Angeles CA 90034

THE GOOD . . .

With all the bad deals consumers seem to get hit with these days, there's still hope for us.

I saw an ad in 73 by S. D. Sales, Dallas, Texas: Digital Clock Kit, $9.95 ppd. All parts less transformer and case. Almost too good to be true. I've wanted one of these things for years, but sixty bucks always seemed such a waste for a clock. This offer was more in line with my price range.

I sent the $9.95 and three days later a small box from S. D. Sales arrived. Talk about fast service. But when I opened the little box, alas, the chip and socket were missing. I immediately fired off a letter expressing my displeasure and asking for a free circuit board, if they had one, to dampen my ire. Once again, three days later, another little box. Inside: clock chip, socket, double size circuit board layout, ½ dozen free MV-50 LEDs – and an apology.

In two days time, I laid out a board, reduced it 50%, and printed, etched, and drilled it. By 8:00 pm that night I had it going, and played with it for several minutes trying to get it on the second with CHV.

Now let me tell you I'm impressed to no end. The only problem is that the XYL doesn't understand GMT, and now I guess I'll have to order another one for EDT.

Anyway, all I need now is a box to put it in, and it will make tracking the Oscars and working satellites a lot easier.

I've got to hand it to this company – a real bargain, and once again 73 scores with me.

Bill Richarz WA4VAF
Charlotte NC

That digital clock kit, $9.95, from S. D. Sales, Dallas, is great. Several already in operation here at State Tech plus one on my operating desk at home.

LeRoy Dean Clough W5GQV
Waco TX

As you know, some "bargains" are not anything of the kind, but the Digital Clock Kit advertised in the June issue by S. D. Sales Co. is a genuine jewel. The soldering requires a magnifying glass, but the results are worth the trouble. A lot of thought went into the kit. I've ordered more.

You may or may not be interested to know that my "Me Friend" piece in the June issue brought some unexpected mail – W6DEF, K6AJG, K3CHP and a half dozen or so others which were inadvertently filed in the IRS basket and lost before I could answer them. Sorry about that – I'm scrupulous about answering nice letters. Anyway, it surprised me.

Ken Cole W7IDF
Vashon WA

A longtime contributor to 73, W7IDF swears up and down that "Me Friend" was his only connection with our June issue. Our sources in the Northwest, though, report that Ken has been sighted at several watering spots in the company of none other than "Dear Gabby" (June, page 172). – Ed.

THE BAD . . .

I am also a victim of Trigger Electronics, 7361 North Ave., River Forest IL 60305. I mailed an order on Jan. 4, 1975, and the check was cashed Jan. 13. Both sides of the check show the stamp, "Trigger Electronics – Trigger W9IVJ". According to the Callbook, W9IVJ is "Irael Treger", whose address is the same as that of Trigger Electronics.

I've mailed him a copy of the check, and I'm waiting a few weeks for the results before I give another copy to the "postal inspectors". If enough folks can put "postal inspector on the ball", perhaps it could then start rolling in the right direction. To me, this appears like using the "mail to defraud" – and it's time we went after him.

Scotty Bottom
Worcester MA

AND THE UGLY

This is my first letter to a ham magazine. I am writing in to protest the way I was treated while working for my Novice license. I do, however, want to say that I have met a few amateurs who did help me. But for the most part I was treated as if I did not exist. I did join an amateur radio club, only to find the club was of little or no help. When I would ask one of them to help me with code they would say they had no time. When I would ask one of them to help me with theory the answer was there was nothing they could do to help me. Well, the fact remains that I am one of those people who, finding a wall in front of him, will fight to overcome it, and I did – I have my Novice license.

And the thing that kept me going was the thought of being able to walk in and tell them that even without their help I got my license. Most people are not like that – if they hit a wall like that they give up. Proof of that is shown by the fact that I brought 3 friends who are very interested in radio to the club and only one of them stayed. I think these hams who think themselves so great had better wake up to the fact that they are going to lose to CB operation many would-be hams because of their way of treating newcomers.

Wayne S. Gateman WN1UXS
Newton Centre MA

WRISTFUL OF DOLLARS

After a little bit of experience with the quartz digital watch I won in your bumper sticker contest at the Dayton Hamvention, it is hard to recall how I got along without it. Resetting my previous watch several times a week had become a way of life for me. Now a weekly hack with CHU or WWV keeps me within a second anytime. Needless to say, I am quite happy with my new CHRONEX.

Funny thing, Wayne, many people have remarked about how lucky I was and how they never win anything. I always ask if they were aware of the contest – those who subscribe to HOTLINE invariably were. Then I ask if they got a bumper sticker and put it on their car. So far, not one has answered yes. How can they win if they don't try? For me it meant a 50¢ LED watch and a free bumper sticker.

Thanks very much for the contest. I hope you have more. There are lots of other things I could use . . .

Dixon Switzer W8KRV
Bellbrook OH

FAT ALBERT AND THE MOB

Have read your magazine ever since I saw a copy in the PX when I was in Germany in 1962. Outstanding!!! Especially the editorials about the Infernal Revenue Service. Have been in ham radio since 1956 and started out in Albuquerque. Am now in a town that is in the fringe area of 5 repeaters (60-140 miles away) and has only 3 active VHFers! Your readers' comments on overcrowded channel conditions on 2m are hard to relate to when the only active channel is 94!

I would like to suggest a new ally (if we'll appeal to them) in the hams' fight to keep CB off 220: namely, the military and NASA. Out west of us here in New Mexico is White Sands Missile Range, and Holloman Air Force Base, both top secret installations. They are so important they have an FCC frequency coordinator, out in the boondocks! Any ham who calls out on 220 will be told to move immediately! No ifs, ands or buts. Those frequencies are used extensively in this area – "get off, period.", etc. Now, I ask you, will the unruly mob now squatting on 27 MHz cooperate, or even attempt to cooperate with this lawful order (shared with government radiopositioning service, which has priority)? Lord NO, they won't!!! Therefore, my suggestion is: write to the Army, which runs White Sands and other similar installations, and write to NASA. Tell them of the devastating consequences to their vital efforts if CB is allowed on 220, and ask their help. Remind them that when they ask hams to QRT it is done. Tell them that the frequencies they occasionally need so much will be complete and utter chaos if Fat Albert and the mob come up on 220. Our fight may be ended much quicker this way.

Bob Isselhard K5INW
2100 North Cielo
Hobbs NM 88240

STLRRMH

We thought that you would be interested to know that we have developed what could set a precedent in two meter communications contesting. We call it "Spontaneous, Time Limited, Rapid Relay, Message Handling". It is, in essence, a message issued suddenly, without any previous announcement, on a local repeater. Included in the message is the starting time, ending time, and encouragement to send the message via two meter repeaters as quickly and accurately as possible. At the end of the message is the address of the originating station (or club) requesting a copy of the message, and the location of the last repeater that it went through.

Following is a copy of a message that we sent last April 26, and the response that we received.

Original

Message No. 1: Originated by STARRS, WR2ABL. Date: 4/26/75. Time: 9:45 am. Text: Please relay this message through available two meter FM repeaters as rapidly and accurately as possible until 12:45 pm today. At that time, it is requested that the last station receiving this message please send a copy to STARRS, P.O. Box 301, Corning, New York 14830. Thanks.

Response

No. 1A: From WR2ADL/Check 45 / Daytime Group 0953/ 4/26/75/// Text: Please relay this message through all available FM repeaters as rapidly and accurately as possible up hill 12:45. It is requested at this time the last station receiving the message be sent to S.T.A.R.S., P.O. Box 301, Corning, New York 14830. Thanks.

This response was sent in by Guy R. Williams at Corry, Pennsylvania. The message traversed several repeaters located at Elmira, Owego, Binghamton, Ithaca, Auburn, Rome, and – we theorize – Syracuse, Rochester, Buffalo, New York and Corry, Pennsylvania.

We believe that this type of two meter message handling has not really been tried before (at least we have not heard of such) and hope that it might catch on as a method of contesting, and also as a technique of excercising the potentially great capabilities of two meter repeaters.

Bryant Hozempa WB2LVW
Editor – Kerchunk
Director – S.T.A.R.R.S.
Corning NY

THE FLIPPER SHOW

That slide synchronizer in the June issue, page 155, is a good start for a slide show. However, depending on the money and time you want to put into your system, you can do some incredible things with slides synchronized with sound.

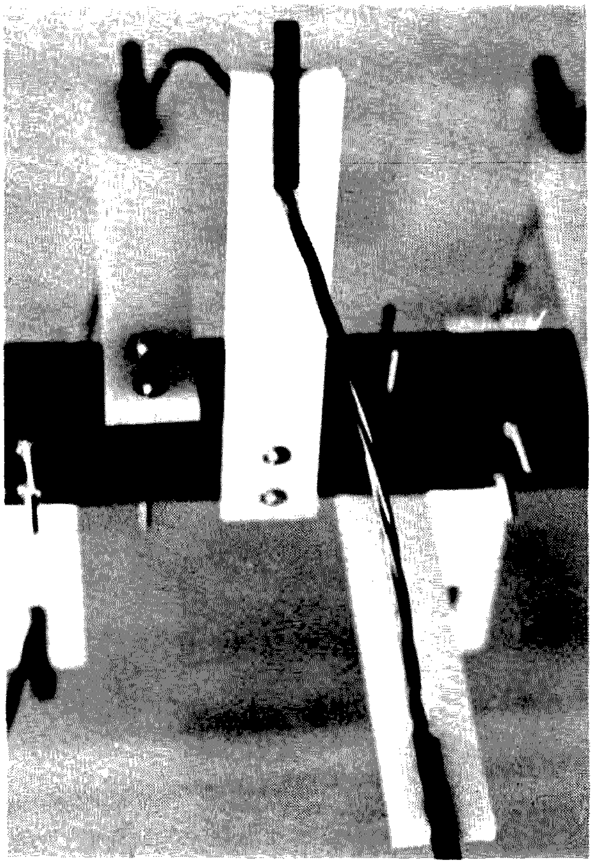
If you have two projectors of roughly similar make, that have control of the lamp circuits and change circuits, you can keep the screen from going dark with a gadget called a Flipper. Simply, it switches back and forth the lamps, immediately after the "flip" command is given from a pushbutton control or tape synchronizer – and then, the projector that is "dark" changes slides. This allows you to switch images on the screen almost instantly, and in time with music, and can create some spectacular effects. Those of you with digital knowledge can see how some TTL and a couple of relays can do the job for less than twenty bucks. You will gulp when you hear that the cost of a commercial Flipper is $120.

Continued on page 130

Alan L. Bridges WB4VXP
2754 Pine Hill Dr. NW
Kennesaw GA 30144

The Oscar Zapper

Part Two

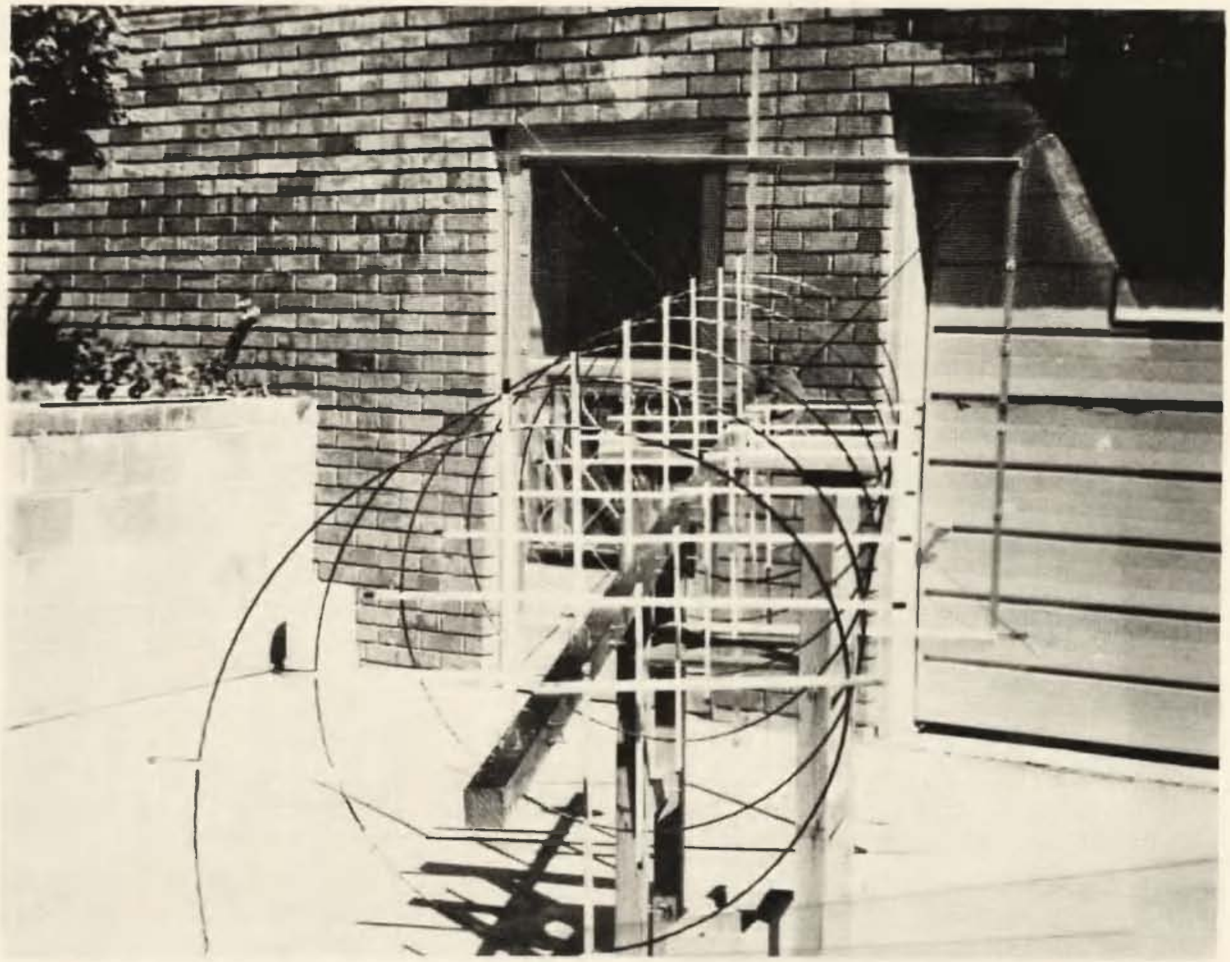


The plexiglass supports of the 70 cm helix with the helix conductor mounted on the supports and with the plexiglass rods permanently bonded to the strips. Note how close the supports are, and the spacing of the supports every 90° along the turns of the helix.

Last month, I discussed the basic characteristics and the general design parameters that one must be familiar with in talking about helices. This part of the article is devoted to the actual construction of the antennas and the installation of the array at my QTH. Basically, the antenna array is four helices mounted on a thirty foot tower with an azimuth-elevation drive. The original installation was completed last summer, but this spring I have taken the array down to modify the az-el drive; this will be discussed later on in the article.

Design, Construction And Installation

The helices that make up the array consist of a pair of antennas, of opposite sense, for both 2 meters and 70 centimeters. The basic design parameters were followed fairly closely. A circumference of 1.00λ was chosen, although after having constructed the antennas the measured or actual circumference was nearly 1.05λ, an acceptable value. The design or center frequency for the helices was 146 MHz and 432 MHz respectively for the 2 m and 70 cm bands. The dimensions corresponding to these frequencies were calculated according to the optimum design parameters, and for C_λ = 1.00λ the spacing S_λ and the diameter D_λ are summarized below.



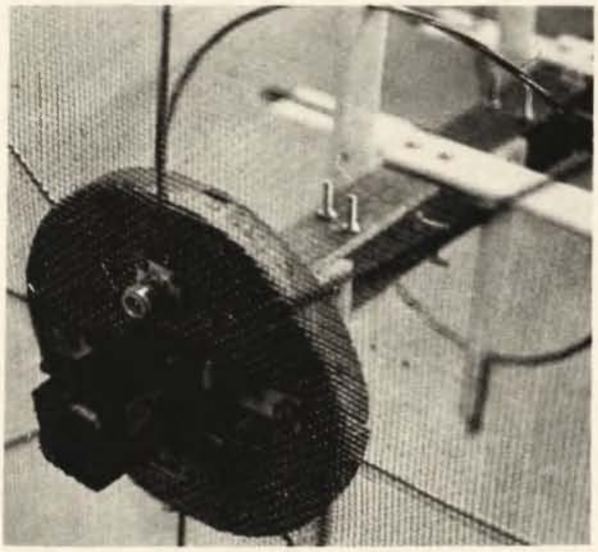
The 2 meter helix under construction. The ground plane is 6 feet in diameter and here the helix has 8 turns instead of the 6 turns that we end up with.

For the 2 meter helices:
- λ = 80.9 in = 2.05 m
- $C\lambda$ = 1.00λ (Actual value ~ 1.05λ)
- $S\lambda$ = 0.22λ = 17.8 in (Value of ~ 18 is used)
- $D\lambda$ = 0.32λ = 25.9 in

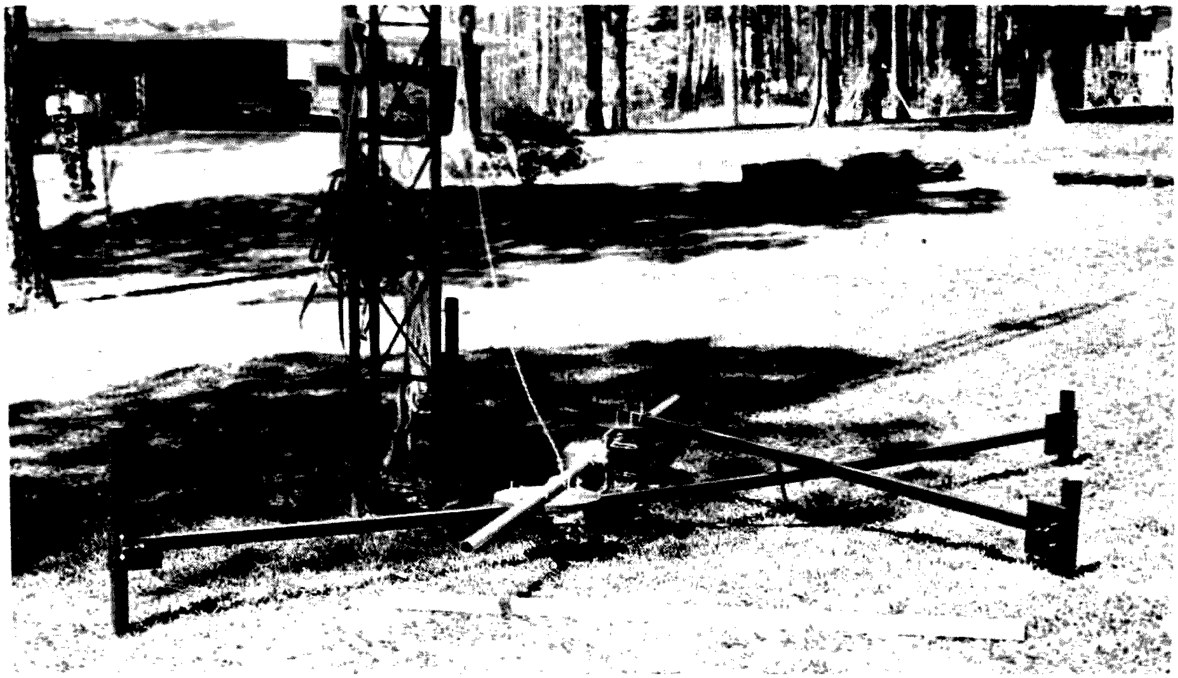
For the 70 cm helices:
- λ = 27.3 in = 69.4 cm
- $C\lambda$ = 1.00λ (Actual value ~ 1.05λ)
- $S\lambda$ = 0.22λ = 6.0 in
- $D\lambda$ = 0.32λ = 8.8 in

For the 2 meter helices the spacing and diameter are roughly 18 and 26 inches, whereas on the 70 cm helices the spacing and diameter are roughly 6 and 9 inches, respectively. The axial length, $nS\lambda$, plus the distance from the ground plane to the first turn of the helix, is the total length of the helix, and for the 2 m and 70 m helices this is approximately 9.75 feet and 52 inches, respectively.

After designing the antenna on paper one



The ground plane and the angle brackets used to mount it to the mast. The wooden disk fits onto the mast of the helix (70 cm helix shown here). The chassis mount type N connector is mounted about 2 inches off the axial center of the helix. Brass welding rods are used to support the hardware cloth.



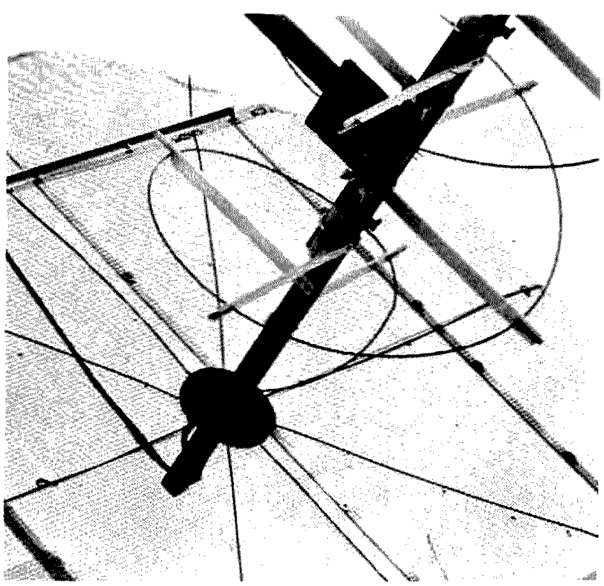
The array support structure before its completion. The "X" structure is incomplete in this picture. Here the rotator (elevation) is mounted on the horizontal boom, which is subsequently attached to the "X". Note the "T" structure on the ends of the "X". The "X" is mounted so that each leg is on the opposite side of the horizontal boom, and this requires that wood spacing be put in between the two legs at the crossover point.

must find the most practical way to assemble it and also utilize available materials. I first thought of using copper tubing for the helix conductor, but after calculating the length that was needed and figuring the cost I was easily dissuaded from this route (for 2 meters about 6.8λ of wire are used). I used three strands of 12 gauge copperweld wire. The next step in the process is to support the conductor and to engineer a support structure for the driven element that would be light, durable and structurally sound. The most important factor here is to preserve the symmetry of the helix, that is, to prevent the conductor from becoming egg-shaped. Also it is important that each turn is 1.00 wavelength long – here there is some room for error since small errors in measurements, mounting of the supports, etc., can throw off the circumference by as much as 0.10λ (an accuracy of about ±.05λ in the circumference is acceptable). Also, in designing a support structure for the driven element one must consider the ease or difficulty of winding or placing the conductor on the supports and securing the conductor firmly while adjustments are made. I decided on using a wooden antenna mast with insulating supports (plexiglass) extending out from the mast at every 90° along the turns of the helix. The pictures reveal the basic ideas and construction techniques. I used high quality 2 x 2 for the masts, treated with linseed oil and painted with outdoor enamel after measurements and drilling were completed. The insulating supports are quarter inch thick, white plexiglass; each support is about 1 inch wide and of an appropriate length for the antenna. This requires a total of (4n + 1) strips of plexiglass for n turns; I bought a large sheet of plexiglass and then cut it into small strips that were needed. Each strip was machined so that the conductor could be wound on these strips after they were mounted on the mast. Each strip has two holes drilled on the end that is to be mounted to the mast and a slot that will hold the conductor on the other end. The dimensions that yield the correct diameter and spacing after the strips are mounted and after the wire is placed on them is calculated from the geometry of this type of structure. It was necessary to make accurate measurements here as any errors would result in an egg shaped conductor, i.e. non-symmetric shape. The basic idea is to

place the wire or conductor of the helix in the slot and to just wind it through so that the shape is very nearly perfect. If my measurements were accurate, then the shape of the helix would be perfect, and I think that this success can be seen in the photos.

After the wire is placed on the plexiglass supports and adjusted, a small piece of plexiglass is placed in the slot and permanently bonded to the white plexiglass support. This small piece of plexiglass is ¼ x ¼ x 2¼ inches long colored plexiglass rod. An alternate and better way to support the wire is to drill a ¼ inch diameter hole and then wind the wire through. This has been tried on prototypes (both before and after this array was completed). Once the plexiglass rods are in place and bonded, the helix conductor can still be adjusted, and is epoxied to the plexiglass supports.

Since the helices for each band are of opposite sense, it was necessary to mount the plexiglass supports so that the sense would be correct. Also, it was noted that the wire used was wound in a right-hand sense, and when the left-hand helix was built it was necessary to uncoil it and rewind it in the opposite direction as it was placed on the structure. With the stiff wire, this turned out to be quite a difficult task.



The 2 meter helix, showing the plexiglass supports and the rest of the mounting structure. Note the wooden disk, the hardware cloth, and the aluminum angle stock used to construct the ground plane. The angle stock is mounted on the disk, after which the hardware cloth is attached to both the disk and the supporting structure. The feedline is seen behind the ground plane. The "T" of the leg of the array support structure is attached to the mast of the 2 meter helix with 4 U-bolts.

The ground plane essentially consists of hardware cloth that is mounted on a wooden disk before installation on the mast. The larger ground plane is supported by aluminum angle stock. The ground plane diameter is 6 feet and 32 inches, respectively, for the 2 m and 70 cm helices. Two angle brackets are used to secure the ground plane to the mast.

The feedpoint is slightly off center, but this does not critically affect the performance of the antenna (although it does appear in the antenna pattern). A better ground plane would consist of a metal plate with the connector mounted on the disk; this aluminum or brass disk could be square, with radials extending out to obtain the desired dimensions of the ground plane. Before the antenna array was installed on the tower, all metal parts were coated with a rust preventive (Val Oil). The antennas were completed separately and then installed on the array support structure, but before the array was installed, Cliff Burdette WA8GRE, of the Engineering Experiment Station, Georgia Tech, and I made far-field antenna pattern measurements which will be discussed later. The array support structure is shown in the photos. In order to put up the four helices this structure must be capable of supporting them and also rotating them. Basically the azimuth rotator is a TR-44 and is mounted on a mounting plate inside the top section of the Rohn tower. The elevation rotator is an RCA 10W707 rotator. This rotator is mounted horizontally in an azimuth-elevation system similar to that used in Reference 9. A better elevation system, like the system used by K6HCP (Reference 8), is desired, even though this system seems to work well. The horizontally mounted rotator is mounted via a small steel plate to a tower mast pipe that extends up from the azimuth rotator through the top section of the tower. This pipe is quarter inch wall 2-1/8 inch diameter steel, about 4

feet long, that was found in a local junk yard. Through the elevation rotator is placed a 1-1/2 inch diameter heavy duty, 10 foot length of conduit. The basic array support structure is built about this horizontal boom. This structure is basically an "X", with a helix mounted on each leg of the "X" structure. The center or crossover point of the "X" is off center, and the horizontal boom about which the array is rotated in elevation is about 2.5 feet below this point. The points where each of the legs cross are permanently secured to each other. Each leg is about 12 feet long, and this makes the array about 11 x 11 feet. The legs are secured to the horizontal boom with a wooden disk and with U-bolts and lock-washers. The ends of the legs, where the helices are mounted, consist of a "T" made of a small piece of 2 x 2, metal mending plates, and a 6 x 6 inch piece of very hard wood. The larger helices are mounted to the "T" with four U-bolts and appropriate hardware. The smaller helices are permanently mounted to the "T"'s. A wooden brace is attached to the 2 m helices as seen in the photos. Also, a counterbalance, consisting of another 2 x 2 about 13 feet long, is attached to the upper part of the array where the smaller helices are mounted. Weights can be attached to this. The total array weighs about 80-100 pounds. Once the antennas were mounted on the structure, which itself was supported by a rope attached to a gin pole mounted at the top of the tower, it was necessary to get some help in order to haul it up. The feedline also had to be mounted and the swr checked out before the antennas were pulled all the way up and installed. The swr was checked by raising and lowering the array to a height of about 20 feet (more on this later). The tower on which the

The support structure of the helix conductor or driven element. The plexiglass strips are spaced every 90° along the turns of the helix. Also shown is the "T" used to attach the helix to the array support structure. The ground plane is to the left. Note the symmetry of the helix and also the small plexiglass rods on the ends of the plexiglass strips where the conductor is mounted and epoxied to the supports.

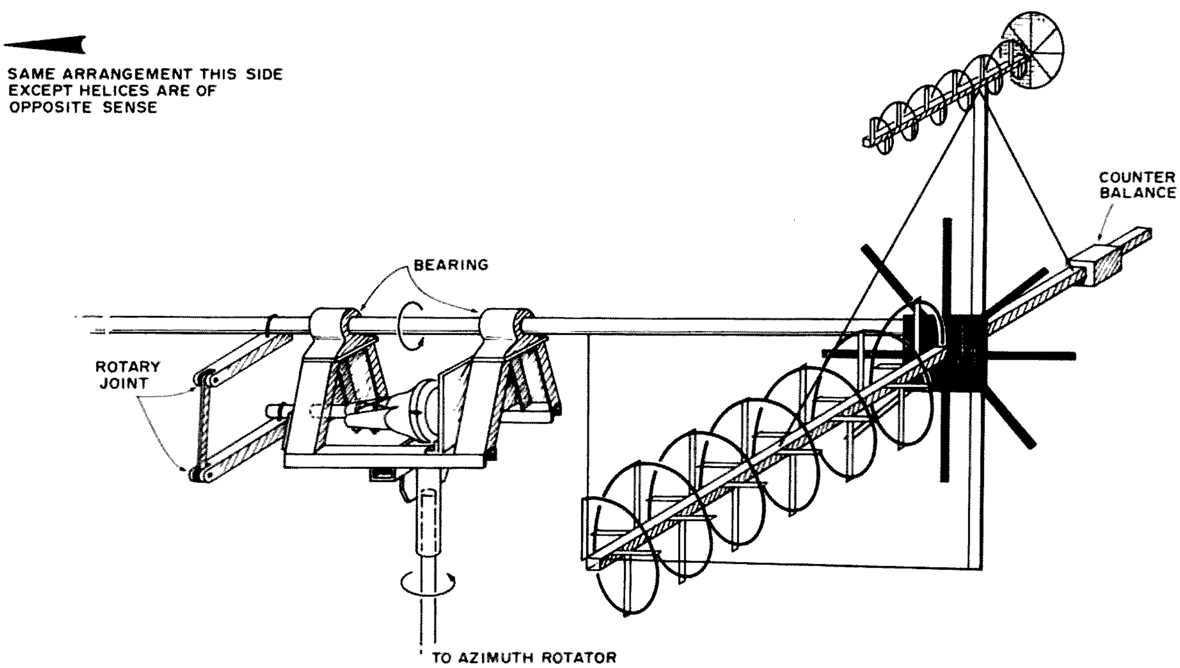
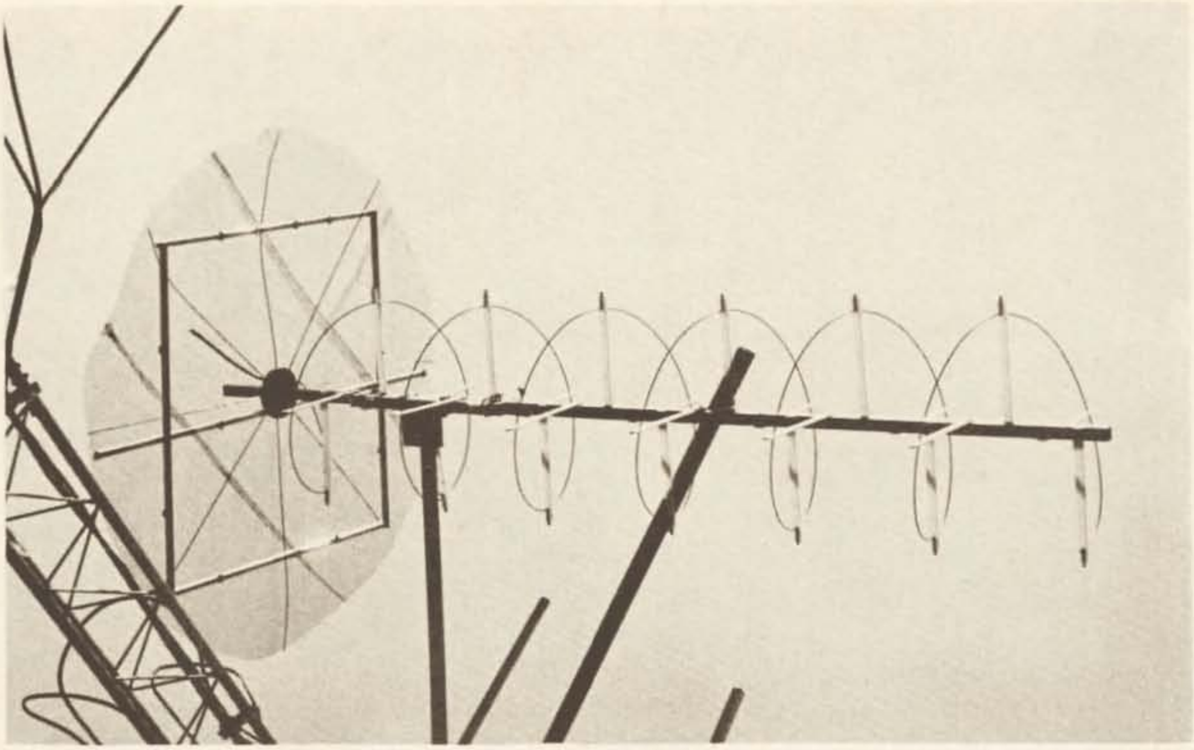


Fig. 4. Half-view of the updated version of the array, showing how the helices are mounted on the main boom and illustrating the az-el system and the antenna frame. The rotor is a Ham II mounted horizontally, covered to prevent the entrance of moisture. The main antenna boom is mounted at the top of the frame (or fork) through two bearings. This boom is rotated by the lever assembly. The rotary joints are tie rod ends (a surplus C141 assembly). At the bottom of the frame is the assembly that attaches to the azimuth rotor. Here a two inch inside diameter aluminum tube slips over a two inch outside diameter pipe, which in turn is attached to the other Ham II inside of the tower. This arrangement eliminates major stresses and windmilling of any kind.

antenna array is mounted is a Rohn 25, with a section mounted in three feet of concrete. It is about 27 feet high and is non-guyed. To install the array I used a regular gin pole plus a commercial gin pole designed specifically to be used with Rohn towers. The antenna array was hauled up by using a block and tackle hoist as well as the two gin poles. The last two feet were the most difficult, and eventually after much sweat and some very exasperating work hurrying to get the bolts secured, while the people on the ground held the array suspended in the air, the array was installed. Both the antennas and the array have been successfully subjected to hail storms and high winds — and even two tornadoes which passed through the area.

Since the original construction and installation were completed last summer, there have been some additions and changes in the array. First of all, during February 1975 there were two severely damaging tornadoes in the Atlanta area. One struck the McCollum Airport, which is less than ½ mile from my QTH, and the other one destroyed a great part of northwest Atlanta. With the one that struck here in Kennesaw, my antenna array felt the high winds and hence suffered some damage. As I now travel most of the time as a sales representative, I came home to find that the tornado and the high winds left the array windmilling, i.e. rotating freely in the wind and just barely attached by a safety (aircraft) cable that I had installed just in case this might happen. I immediately lowered the array as I did not want it to fall if another tornado came through. I had been planning to lower it anyway to revise the az-el system and redo the basic mounting of the antennas.

During May and June I redid the array. In my original installation the problems were mainly mechanical, i.e. mounting of the antennas and rotating them in elevation was not as strong as I had hoped. Basically the new az-el drive and antenna frame, which can be seen in Fig. 4, was designed so that a large moonbounce antenna array could be rotated easily. A drive system like this has been used by DJ9JT (see Ref. 16). The basic arrangement consists of a frame, very similar



The 2 meter helix as viewed from ground level with a telephoto lens.

to a telescope fork, through which the main antenna boom is mounted. This boom is supported by bearings. The elevation drive is mounted in the lower part of the fork assembly. Here a Ham II mounted horizontally is to be used. A short section of tubing connects the drive motor to the mechanical arrangement used to drive the main mast. This is a basic lever, with the rotary joints being surplus tie rod ends. When the drive motor is engaged, the upper boom will rotate as does the lower boom, due to the lever-action. A chain drive could have been used instead of this particular arrangement. The main boom is 6061-T6 aluminum tubing, with an o.d. of 2.5 inches. This boom is 21 feet long and all of the antennas are mounted about this boom. The fork was made up of surplus materials, mostly aluminum, and was HeliArc welded. At the center of the fork on the bottom side, a piece of 2 inch i.d. 6061-T6 aluminum tubing is HeliArc welded. A 2 inch o.d. pipe can be inserted and then secured; the other end is then attached to the azimuth rotor (Ham II). This fork assembly has eliminated major stresses that caused most of the problems in my original mount. Also, I have replaced the TR-44 with a new Ham II. The major problem is wind resistance, and since the Ham II has a 7.5 square foot rating as compared to the 2.5 square foot rating of the TR-44, this replacement has eliminated tendencies of the array to whip around in the wind (mainly the clamps slipped). I am also using the Ham II in elevation. This has also been successfully done at Philco in Vandenburg, California, as well as by Jacques Cousteau on his research ship. The major cost factor here was the rotors, as everything else used surplus or otherwise cheaply available materials.

I have also modified the mounting of the helices. This time I did not use this "X" mounting as before, but used more of an "H" type mounting as seen in Fig. 4. I have also tried to make the array as lightweight as possible by redoing the mounting, adding counterbalancing, and by reducing the weight of the groundplane on the 2 meter helices. On the 2 meter groundplane: Here I have replaced the whole groundplane with a 3/16 inch thick aluminum plate, about 15 in. by 15 in., that has 8 radials of aluminum mounted on it. I also have a lighter mesh that is 4 feet by 4 feet, and this is attached to the radials which extend out as in the

drawing. This reduced the weight considerably, as I used really heavy hardware cloth on the original version. Also, I have remounted the helix so that the 2 meter helix can be mounted on the main boom. By having a 6 to 8 foot extension of 2 x 2 beyond the balance point, I can counterbalance the antenna by adjusting a weight along this mast. I have tried to mechically beef up the array in this process, and have also added a gin pole with a winch to lower and raise it.

Impedance Matching

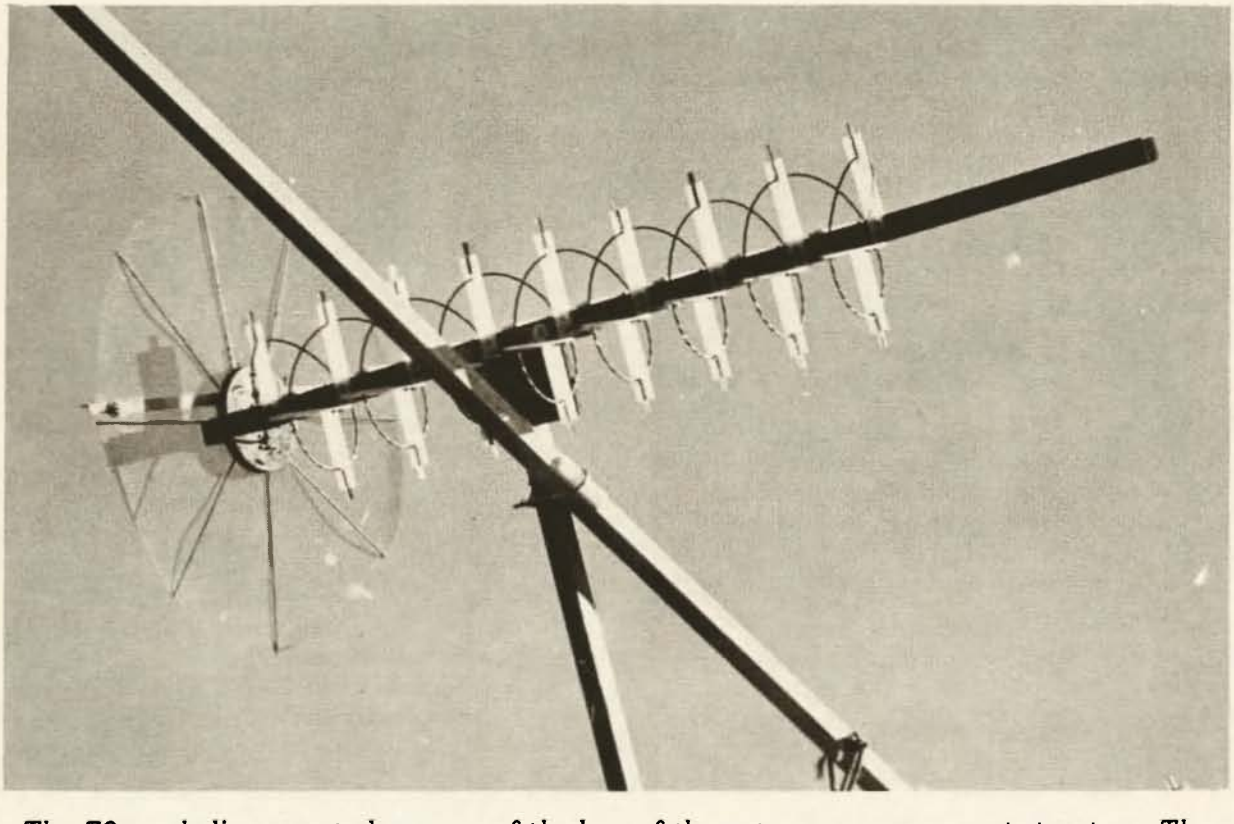
The helix has a terminal impedance of 140 Ohms and is pure resistance. Since 50 Ohm cable was used to feed the antennas, it was necessary to match the 50 Ohm impedance of the RG-8 polyfoam coax to the 140 Ohm terminal resistance of the helix. A quarter-wave coaxial matching transformer is used as in Reference 4. The formula used to determine the correct impedance value is:

$$Z_O = \sqrt{Z_S \quad Z_a} \text{ Ohms},$$

where Z_O is the desired impedance, Z_S is the transmission line impedance, and Z_a is the antenna impedance. This is 83.7 Ohms in this case, and a value of 75 Ohms is very close. Here RG-11/U was used for the matching section and RG-8/U polyfoam coax was used for the feedline. The matching section was made according to the formula:

$$\text{Length (feet)} = \frac{246\ V}{f}$$

where V is the velocity factor for the RG-11/U (approximately .66) and f is the frequency in MHz. Two alternate and even better matching systems are described by Doug De Maw W1CER, in Reference 4. Swr measurements were made with the antenna about 20 feet off the ground, and trimming the driven element was done by lowering the antennas within the reach of a step ladder. An initial swr of 1.7 to 1.8 was obtained on the 2 meter helices, while a similar one was obtained on the 70 cm helices. By trimming



The 70 cm helix mounted on one of the legs of the antenna array support structure. The ground plane is 32 inches in diameter, and has brass welding rods as well as one piece of angle bracket for support. The "T" structure is permanently attached to the mast. The 13 foot long counterbalance is attached with a U-bolt to the leg of the "X". Besides acting as a counterbalance, the 2x2 keeps the two 70 cm helices from whipping around during wind or rotation.

the driven elements, an swr of about 1.5 to 1 was obtained. A better swr could be obtained if a matching section with an impedance of about 83 to 84 Ohms were used.

To obtain a better match and hence a lower swr, I have talked with Mike Staal K6MYC, at KLM Electronics, about building a sleeve balun to match the 140 Ohm terminal impedance of the helix to 50 Ohm coax. By this time I will have either built one myself or else have had them made by Mike. The big problem in popularity of the helix has probably been the impedance matching, and since it is very easy to build the helices and get them working, it would be worth the cost of getting a sleeve balun made by someone who makes them professionally.

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Next month: Measurements and conclusions.

. . . WB4VXP

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Identalert C

for Clock Watchers

To further increase the utility of the Identalert*, a digital, solid state readout has been added. With a minimum of effort you can now watch the time tick by. With a little more effort it is possible to vary the identification cycle for use with repeaters, for example.

Adding a solid state display is accomplished by wiring in six more ICs and changing the power supply to accommodate the increased power requirements of the displays. The Identalert counts seconds derived from the power line whereas the display shows minutes and seconds. One pulse per second is taken from the Identalert as is the reset pulse. Q21, Q22 and Q23 count these pulses and drive BCD-to-seven segment decoders, Q18, Q19 and Q20, which, in turn, drive the GaP displays.

Each segment of each display must have a current limiting resistor between it and its driver output. Rather than use twenty-one discrete resistors, the new resistor networks were used. These are thick film resistors fired on to a ceramic base. They have the configuration of an integrated circuit. In Identalert C, ICR1, ICR2 and ICR3 have seven resistors per package. R20 is used to light the decimal point. If available to you, a resistor network with 8 resistors (CTS 761-3-R150) can be used for ICR2.

My display was built in a separate 5" x 2¼" x 2¼" minibox with a short interconnecting cable (4-cond) running to the Identalert. Be sure to use no less than #18 wire for Vcc and ground wires. We are dealing with a fair amount of current, and voltage drops in the wiring can disrupt the operation of the display.

Because the power supply is required to supply approximately ¾ of an Ampere instead of the 250 mA for the Identalert alone, it is necessary to make some extensive changes to the original supply. Just about all the parts used in the original supply are used and the parts designation numbers reflect this. Where an original part changes value it is noted in the accompanying parts list, i.e., R5 is 10 Ohm 10 W instead of 25 Ohm 10 W. In order to use the original pass transistor, Q15, it is essential that this device be attached to the chassis — which acts as its large heat sink. The original heat sink won't come close to keeping Q15 within its thermal rating. In addition, be sure that the box containing the power supply and the one containing the display have plenty of ventilation — a lot of heat is generated!

After the supply has been built, connect about 6 Ohms (5 W) across the output and adjust R16 and R17 for 5 volts. If there is a length of cable involved, connect the calibration resistor at the display end of the cable. The parts list indicates two different types of trimmer. Whereas both will work, it is advisable to use cermet trimmers for their better temperature characteristics.

I usually avoid using IC sockets, but did so in this case to mount the LED displays. The resistor networks and the sockets for the displays were mounted on a piece of punchboard and this assembly was epoxied, at right angles, to another piece of punchboard on which were mounted the six ICs. The wiring from the networks to the display

*See "The Identalert", K2PMA, 73, April, 1975, p. 89.

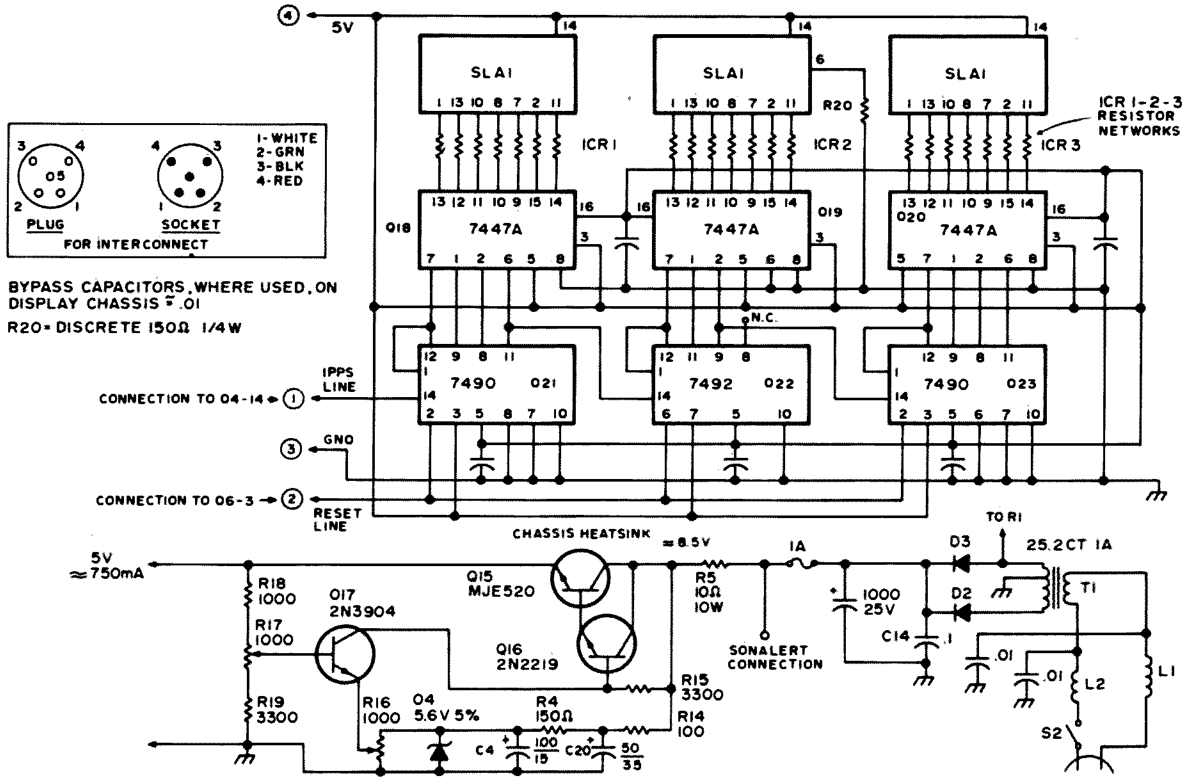

Fig. 1. Schematic.

sockets was accomplished via #22 insulated wire; the same type of wiring was used from the networks to the drivers on the main board. There are a lot of wires in a small space, so some discretion is called for here to avoid shorts. Use a Discap to bypass Vcc for each two ICs.

If you desire to vary the time cycle, wire in a single pole, 10 position, non-shorting rotary switch to Q7 and Q8 as shown in Fig. 2. Remember, the Identalert counts seconds. For example, if your repeater times out at 2 minutes 45 seconds, set the Q7 switch at 1 and the Q8 switch at 5. The Identalert will sound off at 158 seconds — 2 minutes 38

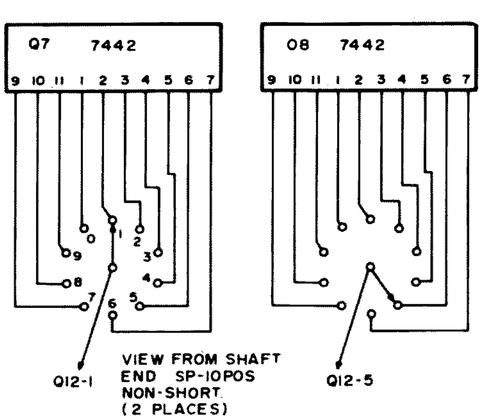

Fig. 2. Switch decode.

seconds on the display. With this device in your shack, you'll never time out! If you add the switches, it is now possible to time events (within 0.1%) up to sixteen and a half minutes. The display will show only minutes and seconds (not tens of minutes), but the "one" can be added mentally.

The Identalert operates just as before, but now you can C how long you've got before an ID or timeout.

Parts List

Displays	OPCOA SLA 1
ICR1, ICR2, ICR3	14 pin DIP resistor network (CTS 760-3-R150)
R4, R20	150 Ohm ¼ W 10%
R15, R19	3.3k ¼ W 10%
R18	1000 Ohm ¼ W 10%
R16, R17	1000 Ohm trimmer (CTS X201R102B or 360S102B)
R5	10 Ohm 10 W
R12	39k
C20	50/35 V lytic
Q16	2N2219 (hfe 80 or better)
Q17	2N3904
Q18, Q19, Q20	7447A IC
Q21, Q23	7490 IC
Q22	7492 IC
F1	1 A

. . . K2PMA

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Digital SWR Computer

Part One

Ask two different designers to design some particular device, and quite likely they will come up with two circuits as different as night and day. It can sometimes be very interesting to compare these circuits to see just how they approach the same problem.

In the November and December 1974 issues of 73 Magazine, Terry Mayhugh W6OTG described his design for a digital swr computer. Shooting for the best possible accuracy practically available, his circuit used 27 ICs, not including those in the power supply. This included some rather exotic op amps, an analog multiplier IC, and a digital-to-analog converter, as well as a variety of precision metal film resistors. K2OAW, on the other hand, says that he was primarily concerned with making his digital swr computer simple and easy to build, even if it might provide slightly less accuracy. His circuit uses 11 ICs (plus one in the power supply), all of them standard, easy-to-get. In addition, his article provides the layout for a printed circuit board about 4 x 6", which mounts all components except for the transformer and directional coupler.

Measurement of swr requires a directional coupler in the transmission line, which provides two voltages, called V_F and V_R, proportional to the voltages traveling in the forward and reverse directions, respectively. The swr is then computed from the equation:

$$\text{Swr} = \frac{V_F + V_R}{V_F - V_R}$$

W6OTG uses precision operational amplifiers to sum the two voltages to provide the top term in this equation, and to subtract the two voltages to provide the bottom term. An analog divider circuit then does the actual division, and a simple digital voltmeter converts the resulting voltage into the displayed digital swr reading.

K2OAW starts off with a similar approach, also using op amps to provide the sum and difference terms in the equation. But then, instead of doing an analog division, he converts the two voltages into digital signals and does the division digitally. This eliminates several hard-to-get components, and also simplifies the digital readout circuitry.

To sum up, W6OTG's circuit, if properly built and aligned, can be somewhat more accurate, while K2OAW's circuit is simpler and easier to build. Even if you don't decide to build either, we feel that you can pick up many useful hints by comparing the two designs. — Ed.

Swr measurements are a common part of an amateur's life. Most active hams have an swr bridge of one kind or another, and often use it to adjust antennas, feedlines, matching networks, or other parts of their antenna systems. Even when everything is finally done, an swr measurement is a useful check to make sure everything is still working properly.

Unfortunately, swr measurements are

simple but awkward. The more affluent hams may have an in-line wattmeter which can measure something called "forward power" and "reflected power." Once these values are read, they have to consult a table or do a short calculation to find their actual swr. On the other hand, most of us have a simpler "swr bridge," which is normally operated by placing a switch in the "forward" position, adjusting a pot for a full-scale meter reading, and then flipping the switch to the "reflected" position to get a reading.

Both of these methods are awkward and time consuming. Though they are simple, some time is required for each reading – and it is hard to make adjustments and take readings at the same time. There is no such thing as slowly adjusting some component while looking for a null in swr – you have to alternately adjust, take a reading, adjust, etc.

Thus there is a need for some sort of swr indicator which can give you a continuous reading without the need to flip switches or adjust pots. Though such a device exists commercially – it is a dual-pointer meter where one pointer reads the forward power while the other pointer reads the reverse power at the same time – it is expensive and still difficult to read accurately and fast. This article describes another approach to the problem of fast and accurate readings – a digital swr computer which automatically computes the swr and displays it on a digital readout automatically every time you transmit. The swr computer is specially valuable when making any kind of antenna or transmission line adjustments, but it can be left in the line permanently to give you a day-to-day check on the performance of your antenna system with just a glance at the digital readout.

The swr computer uses a directional coupler inserted into your transmission line in the same way as any swr bridge. In fact, you may use your present swr bridge just by making three connections to it: bringing out a ground, the forward voltage (V_F) and the reverse voltage (V_R). The computer then calculates the swr from the formula:

$$Vswr = \frac{V_F + V_R}{V_F - V_R}$$

and displays it as a three-digit number between 01.0 and 99.9 on a light emitting diode (LED) readout.

All the parts mount on one 4x6" printed circuit board, except for the directional

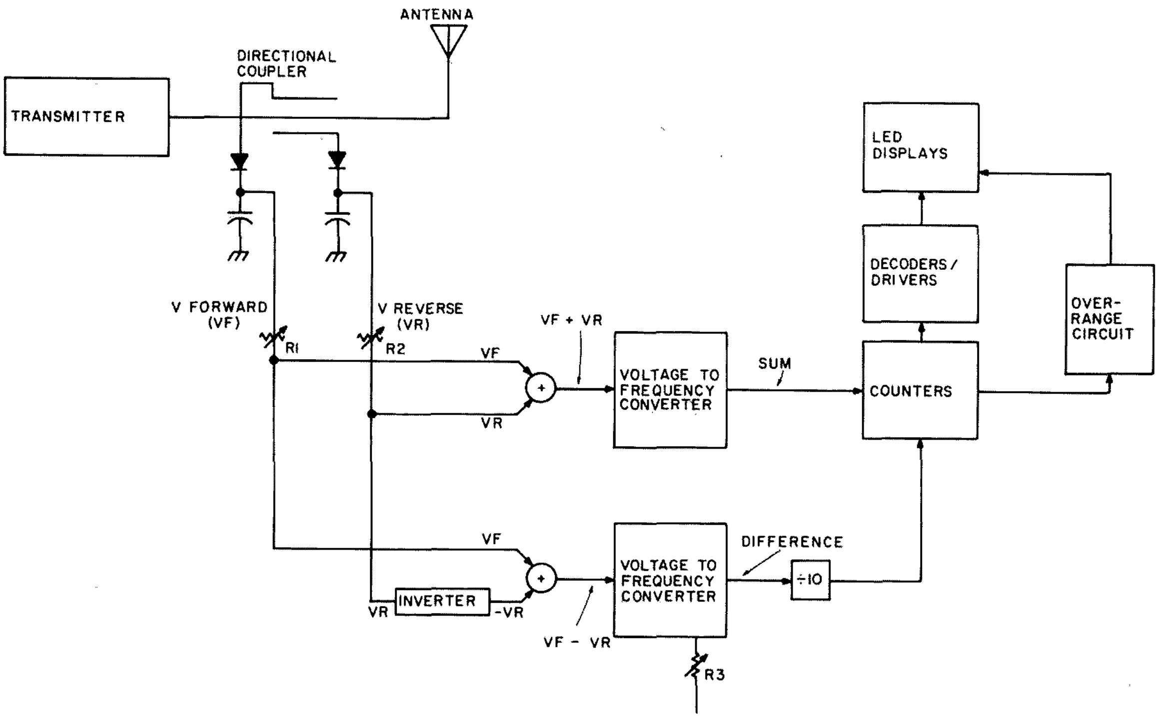


Fig. 1. Block diagram.

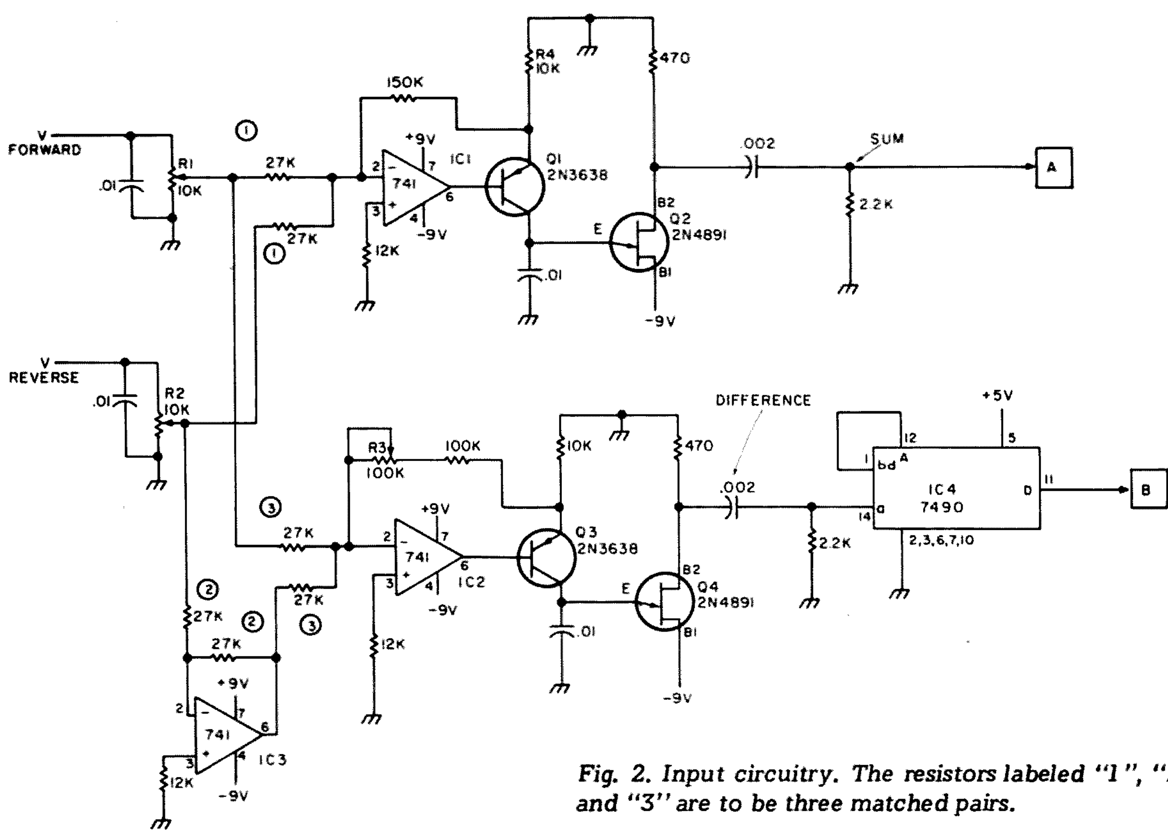


Fig. 2. Input circuitry. The resistors labeled "1", "2", and "3" are to be three matched pairs.

coupler, a 6.3 volt power transformer, fuse, on-off switch, and line cord. The computer is therefore very easy to build and troubleshoot, since the printed circuit board eliminates 99% of your problems. Calibration consists of adjusting only three potentiometers.

The estimated price of the parts listed at the end of the article is about $40, assuming that you shop carefully. (By limiting the swr computer to a two-digit readout instead of a three-digit readout – a maximum swr of 9.9 rather than 99.9 – you can save about $5. A much greater savings can be made if you already have, or intend to build, the K2OAW frequency counter – you can save about $30 by using the counter as the readout device.)

How It Works

Fig. 1 shows the block diagram. We start with a directional coupler, shown in the upper left corner. You may build your own following the ARRL Handbook or any of a number of other designs, or you may use a commercially available swr bridge, such as the $12 Lafayette bridge.

The coupler, using a combination of inductive and capacitive coupling, provides two output voltages called V_F and V_R, which represent the forward and reflected voltages. These are tapped off the coupler circuitry at the output of the signal diodes, as shown in Fig. 1. (Note: Make sure the diodes are oriented as shown to provide a *positive* output voltage to the computer.) For calibration purposes, the V_F and V_R voltages go through R1 and R2, two adjustment pots. An IC inverter changes V_R into a negative voltage $-V_R$ and two IC analog adders then provide the sum voltage $V_F + V_R$ and the difference voltage $V_F - V_R$.

These two voltages are then fed into two voltage-to-frequency converters, which provide a pulse signal whose frequency is proportional to the applied voltage. R3 allows adjustment so that the two converters track each other. The difference frequency is then divided by 10 in a digital divider and both signals are applied to the counters.

The counters are three stages of 7490 decade counters, which count the input pulses arriving from the sum circuit. These counters can count from 000 to 999, and a decimal point is inserted on the LED display so that the count is displayed as 00.0 through 99.9. The resulting count is fed to the LED display through IC decoder/drivers. If the count ever exceeds 799, the overrange

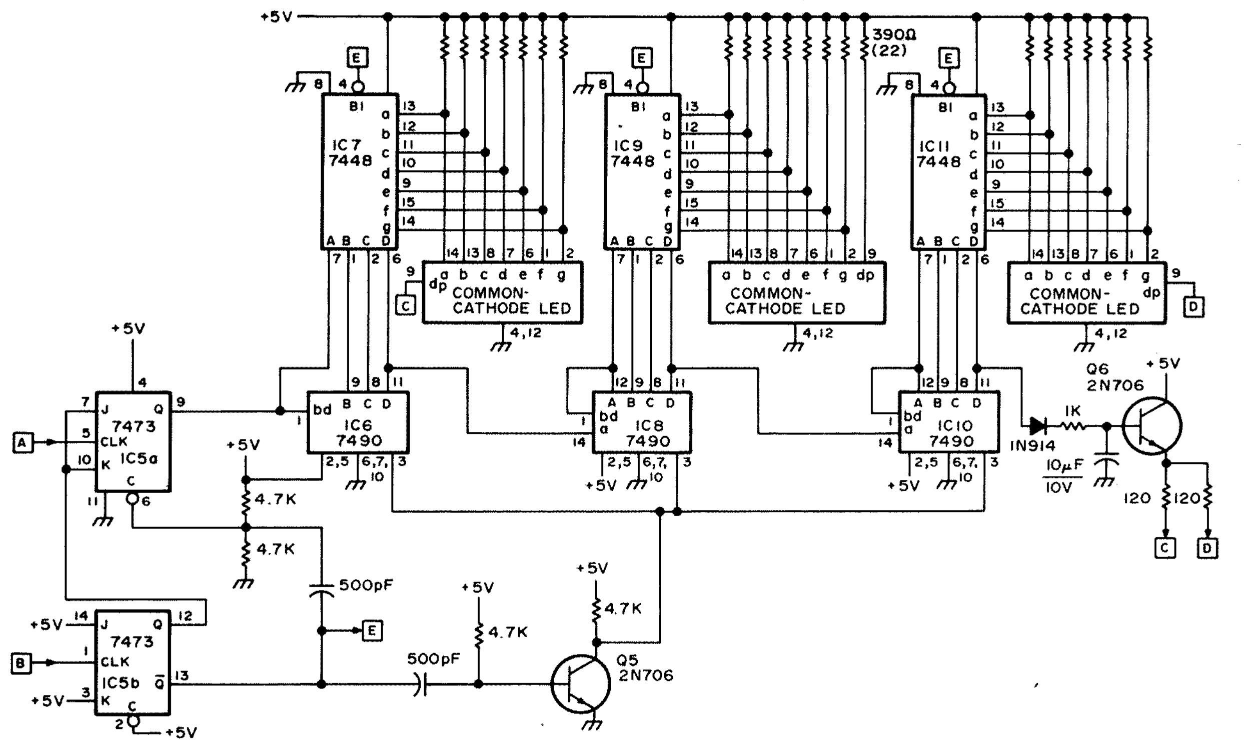


Fig. 3. Display circuits.

circuit lights up all the decimal points to indicate that the swr is very high.

The actual division in the formula:

$$V_{swr} = \frac{V_F + V_R}{V_F - V_R}$$

is done in the decade counters digitally, by allowing the difference frequency to reset the counters back to zero. To see how this is done, let's work through a simple example.

Suppose that the forward voltage V_F is 3 volts, and the reverse voltage V_R is 1 volt. This condition represents an swr of 2. Depending on how the adjustment pots are set, let us suppose that the sum signal, $V_F + V_R$, will be 4 volts, while the difference signal, $V_F - V_R$, will be 2 volts. Then, since the voltage-to-frequency converters are reasonably linear, the sum frequency may be 1000 Hz, while the difference frequency would be half that, or 500 Hz.

Hence the counters get the 1000 Hz signal to count, but are reset back to zero at a 50 Hz rate (since the 500 Hz signal is divided by 10 before reaching the counters). Thus the counters will only reach a count of 020 (which will be displayed as 02.0) before being reset back to zero. In this way, the display shows the true swr. As with any counter, any reading is correct to within one digit, while the voltage-to-frequency conversion process is linear to within about 1 or 2 percent — so the overall accuracy of the computer is easily within a few percent.

Fig. 2 shows the input stages of the computer. Except for IC3, which inverts V_R

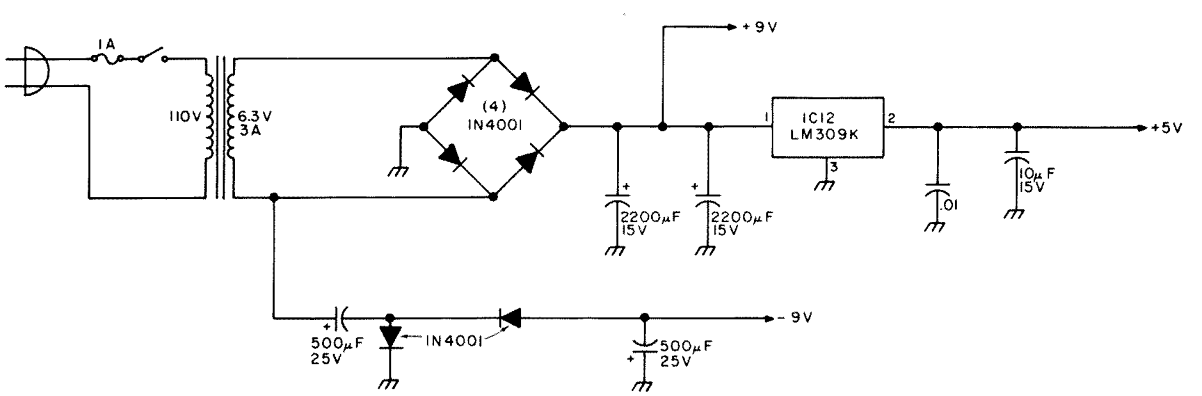


Fig. 4. Power supply.

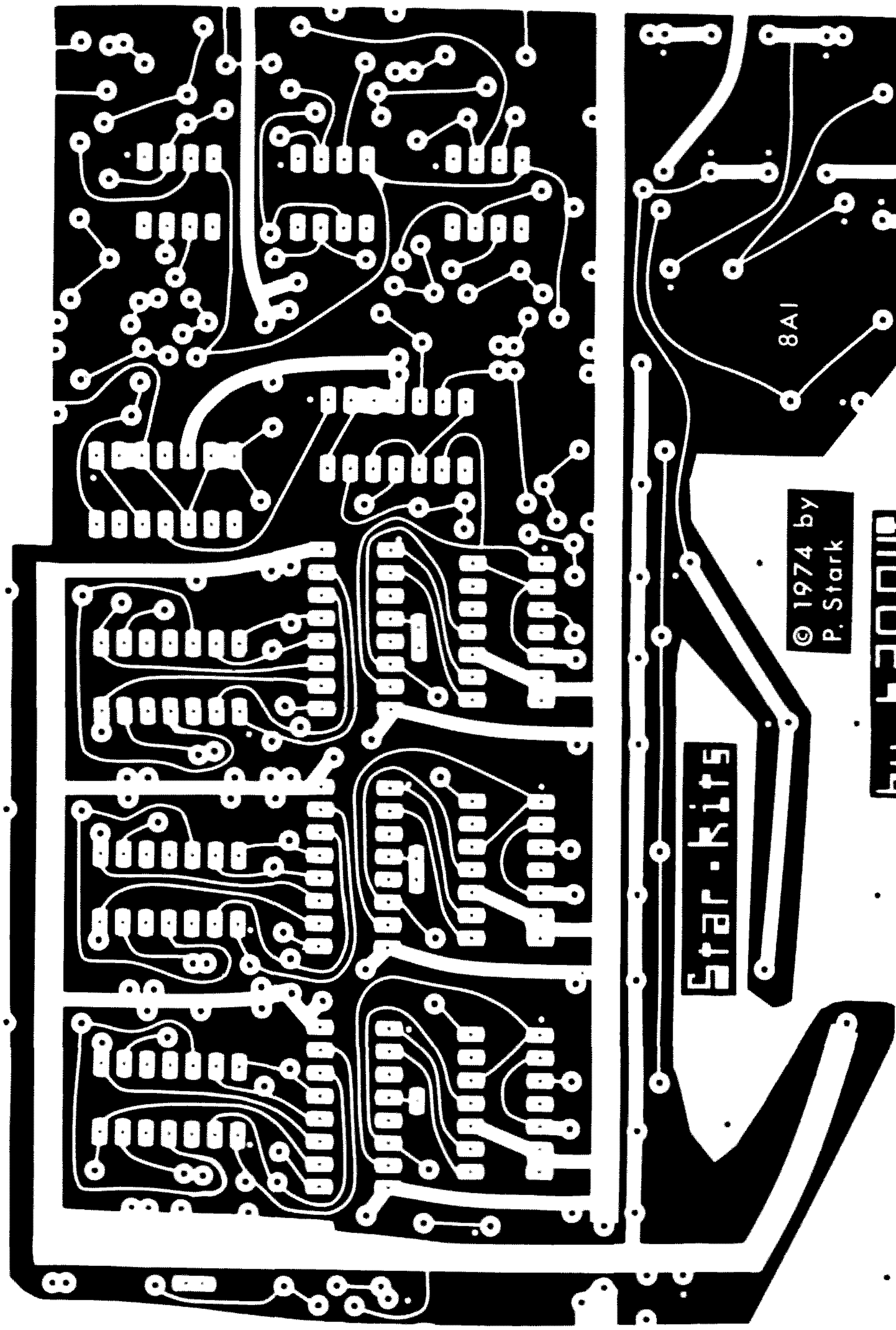


Fig. 5(a). Pc board (full size).

into $-V_R$, the sum and difference circuitry is identical. In the sum circuits, IC1 adds V_F and V_R, and drives a 2N3638 transistor, which acts as a constant current source to charge a 0.01 uF capacitor (which determines the frequency at which the 2N4891 unijunction transistor oscillates). The current which charges the capacitor goes through the 10k resistor in the emitter of the PNP transistor; this produces a voltage drop which is fed back to the input of IC1 as negative feedback, making the overall voltage-to-frequency conversion very accurate. IC4 then divides the difference signal's frequency by 10.

Fig. 3 shows the counters, decoders and drivers, and displays. Except for the operation of IC5, the circuitry is very straightforward: IC6, 8 and 10 are the three decade counters, IC7, 9 and 11 are the decoder/drivers.

IC5a and IC5b control the counting and display functions. Suppose the difference frequency coming in at the B input is 50 Hz,

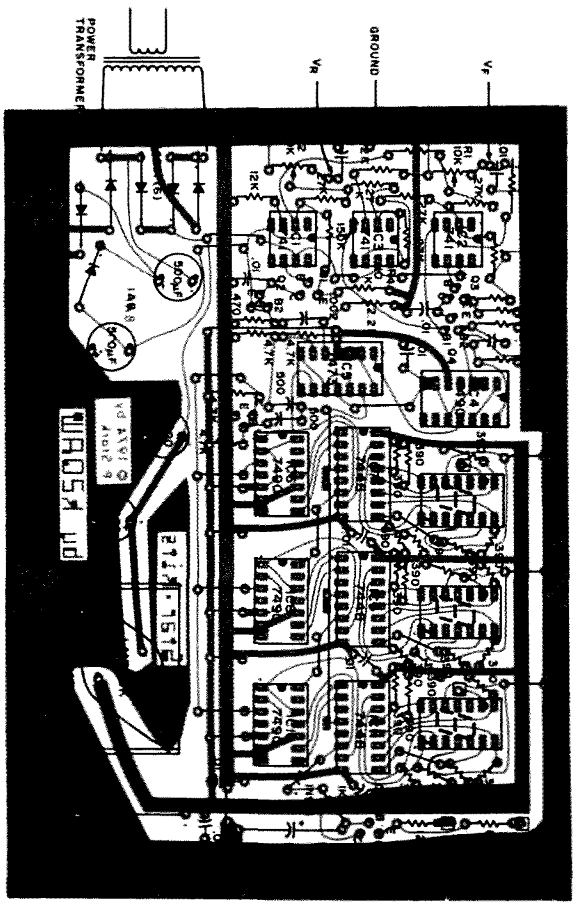


Fig. 5(b). Parts layout.

that is, a pulse arrives every 1/50th of a second (every 20 milliseconds). IC5b is connected so that it flips at every input pulse, so it will be *on* for 20 milliseconds, and *off* for 20 milliseconds.

While IC5b is *on*, its output on pin 12 is positive, which is sent to IC5a; this allows IC5a to accept the sum pulses. IC5a acts with IC6 to count the input pulses, so during this 20 milliseconds the counter is working. If, as in our above example, the sum frequency is 1000 Hz (the sum pulses arrive 1 millisecond apart), then 20 pulses will arrive during this time, and the counter will count to 20. But pin 13 of IC5b connects to IC7, 9 and 11 in such a way that the displays are turned off (a zero voltage is applied to point E, which feeds the BI – Blanking Input – on these ICs). Hence the displays don't indicate anything at this time. When the 20 milliseconds are up, IC5b flips to *off*.

With IC5b *off*, IC5a is prevented from counting as it gets zero volts at its JK inputs, so for the next 20 milliseconds the counters stay at the value they reached at the end of the counting interval. At the same time the BI inputs to the decoders go positive, so the LED display shows this count. At the end of this time interval, when IC5b again goes *on*, short pulses are sent through the two 500 pF capacitors which force IC5a, IC6, IC8 and IC10 back to a count of 000, so that the next count starts again with 000.

The only unexplained circuit is transistor Q6 connected to IC10. As soon as the counters reach a count of 800, pin 11 of IC10 goes positive, which charges up the 10 uF capacitor connected to the transistor's base; this in turn connects a positive voltage to the decimal points on the first and third LED digits to indicate a very high swr. Actually, the swr is too high much before it gets anywhere near 80, and the purpose of this circuit is not to tell you which swr's are OK and which are not. Rather, the purpose is to warn you in case the swr might be computed as something like 101 or 102. Since the maximum swr which can be displayed in the three digits is only 99.9, an swr of 101 would be shown only as 01.0, with the first 1 missing. The extra decimal points are there to warn you of this condition.

Fig. 4 shows the power supply, which consists of a standard bridge and IC voltage regulator to generate +9 and +5 volts, and a modified voltage doubler to generate -9 volts. See the Parts List for comments regarding the power transformer and the heat sink for the regulator. A perfectly adequate heat sink, if the IC is mounted on the board, is a 1 x 4" piece of aluminum, bent into the shape of a squarish U, and mounted under the IC so that the ends of the U stick up off the board. Alternatively, the IC can be mounted on the cabinet.

Construction

With the exception of the power transformer and the ac line components, all the components shown in Figs. 2 through 4 mount on the printed circuit board as shown in Fig. 5. Note the following points before starting to mount the parts:

1) The 500 uF and 2200 uF capacitors in the power supply mount upright; axial lead capacitors will work, though radial lead capacitors fit better.

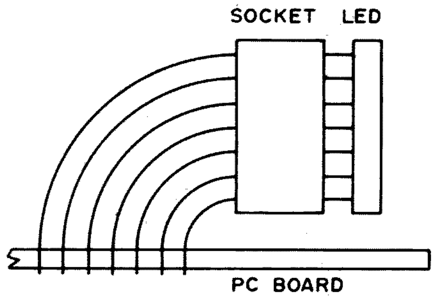


Fig. 6. Alternate LED mounting.

2) IC sockets or Molex Soldercon pins should be used under all ICs and LEDs. Our own preference is Molex pins, as 8-pin sockets for the 741 ICs are difficult to obtain. Moreover, many LEDs have round rather than flat pins, and do not fit into most sockets.

3) The twenty-two 390 Ohm resistors near the LEDs are quite crowded, and some can lie flat against the board while others have to be mounted standing up. Be especially careful while mounting these resistors to leave room for those resistors still to come.

4) The LEDs are shown as being mounted flat against the board, like ICs. This would be an appropriate way of mounting them if you intend to look at the LEDs from the top of the board. Observe especially how the LEDs mount – with pin 1 of each LED towards Q6. The proper way to hold the board for correct rightside-up display is with the LEDs in the lower left corner. In order to be able to mount the board closer to the face of the cabinet, you may wish to place the standup electrolytic capacitors on the wiring side of the board. Either sockets or Molex pins may be used for the LEDs, but make sure that the sockets you use will accommodate the LED pins.

On the other hand, the LEDs can be mounted vertically as shown in Fig. 6, by using short wire jumpers either with a socket or soldered directly to the LED pins. Though somewhat more laborious, the latter mounting method is more convenient if you intend to mount the board horizontally in a cabinet and look at it from the front edge.

5) Most of the jumpers on the board are straight point-to-point wire jumpers, but there are two which have to span several inches; these connect the two points labeled C and D near the LEDs to the two 120 Ohm resistors near the edge of the board. You may place these two either on top or under the board, but make sure they are insulated.

6) The LM309K IC mounts on a U-shaped heat sink made out of a 1 x 4" piece of aluminum (or a Wakefield sink can be used – see Parts List). It can also be mounted on the cabinet, in which case no heat sink is needed if the cabinet is metal. The case of the IC is grounded, so no insulators are needed.

7) To reduce the possibility of errors, a small dot on the printed circuit board identifies pin 1 of ICs, the positive terminal of electrolytic capacitors, and the cathode terminal of diodes.

8) In accordance with good design practice, a number of 0.01 uF capacitors are scattered throughout the board, connected between the +5 – volt line and ground; these are generally not shown on the diagrams. Small 10 or 25 volt units are quite adequate, and are recommended because of their small size. In this application their exact value is not important, and anything from 0.005 to 0.1 uF should work.

9) The 0.01 uF capacitors connected in the timing circuit (the emitters of the unijunction transistors) are important in determining the long term accuracy of this unit. Though their capacity is greatly dependent on temperature, disc ceramics will work here quite well (as long as they are the same brand and type) since the two capacitors should track each other and thus compensate, to a large extent, for each other. Nevertheless, if you are really concerned about accuracy, you might want to consider a more stable capacitor type for this application, such as a polystyrene or mylar capacitor.

10) The six 27k resistors determine op amp gain, and must therefore be carefully chosen. They need not be exactly 27k, but must be selected as *matched pairs*. Each pair is connected to one of the 741 op amps, and the resistors to be matched are shown in Fig. 2. The best way of matching the resistors is with a digital VOM or an accurate bridge, but even a fairly good VOM should be adequate.

11) Under certain circumstances, the digital circuitry may be susceptible to rf

interference from your transmitter. When mounting the board in an enclosure, keep in mind the future possibility that bypass capacitors may have to be added to all inputs – signal and power.

PARTS LIST

Integrated Circuits
3-741, 1-7473, 4-7490, 1-LM309K, 3-7448.

Resistors
10% ¼ Watt: 2-120, 22-390, 2-470, 1-1k, 2-2.2k, 4-4.7k, 2-10k, 3-12k, 1-150k, 1-100k;
1% ¼ Watt: 6-27k. These resistors need not actually be 1% tolerance, but for best accuracy should be matched pairs. They can be 10%, as their actual resistance is not too important as long as they are in matched pairs.

Potentiometers
2-10k and 1-100k, upright printed-circuit type, such as CTS type (avail. at Radio Shack.).

LED Readouts
Three common-cathode DL-704, MAN-4 or equivalent LEDs; other common-cathode LEDs can be used, though board layout may not fit other pin connections. Common-anode LEDs can be used if 7448 ICs are changed to 7447, 390 Ohm resistors are replaced by 220 Ohms, and a different set of connections is used between 7447 and LEDs.

Capacitors (those marked * are upright mount)
Disc: 2-500 pF, 2-0.002, 12-0.01;
Electrolytic: 2-10uF 10 V, 2-500* uF @ 16 V, 2-2200* uF 16 V.

Transistors
2-2N706 NPN switching transistors or equivalent;
2-2N3638 PNP or equivalent, but must have fairly good beta;
2-2N4891 unijunction (Radio Shack RS-2029).

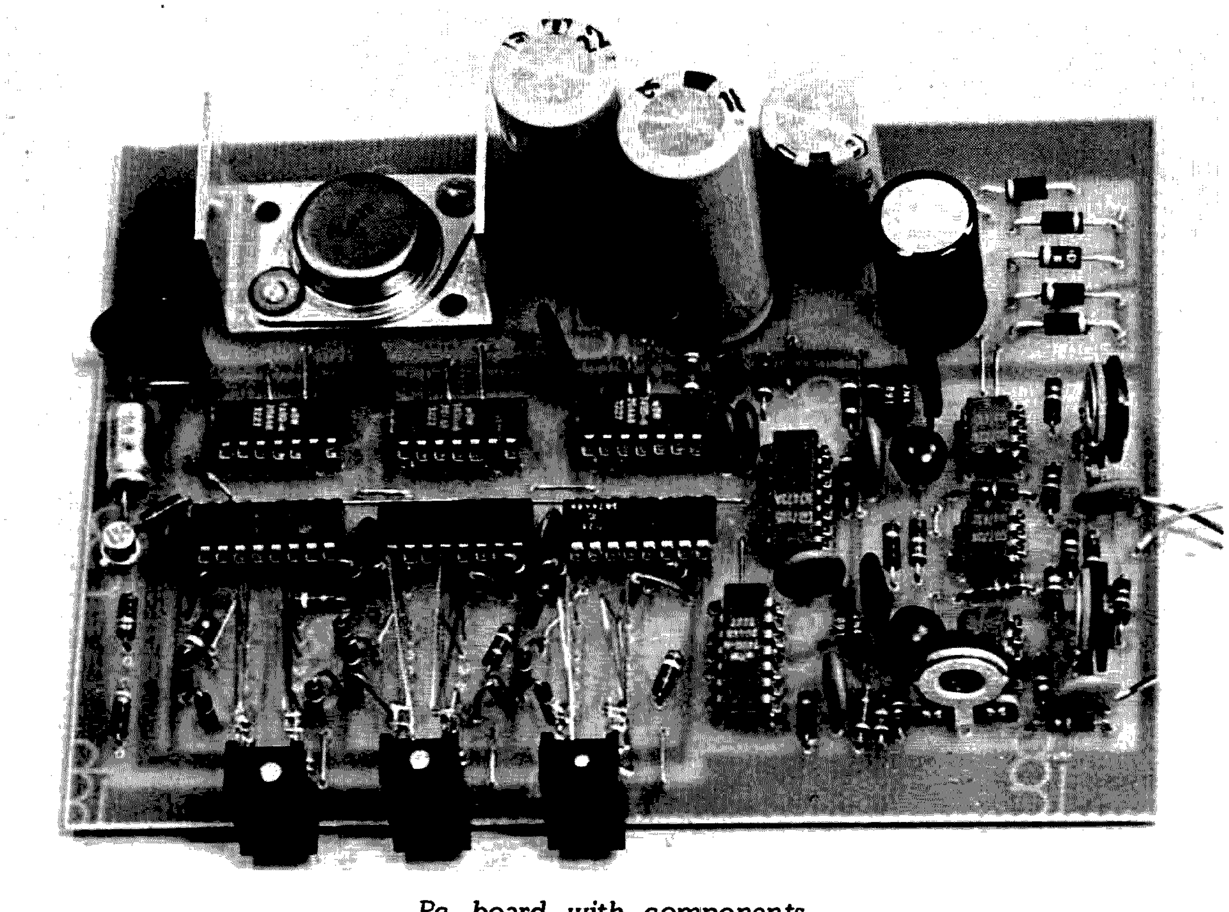
Diodes
1-1N914 or 1N4148 silicon signal diode or equivalent;
6-1N4001 rectifier, 1 Amp 50 piv or equivalent.

Transformer
6.3 volts at 3 Amps. Actually, only about ½ ampere is required, but 6.3 volts is a little marginal. If you can get a 7 or 8 volt transformer, then a ½ Amp transformer will do. Otherwise, a 6.3 volt 3 Amp transformer under this very light load will provide about 7½ volts, which is OK.

Assorted
Line cord, fuse, on-off switch, wire, solder, cabinet, display bezel. Wakefield NC-631-3 or equivalent heat sink, if LM309K is mounted on board; no heat sink required if it is mounted on the cabinet. Also needed is any type of home brew or commercial directional coupler or "swr bridge." IC and LED sockets or Molex Soldercon pins are helpful. Printed circuit boards may be made from Fig. 5; etched and drilled boards are also available from Star-Kits, G.P.O. Box 545, Staten Island NY 10314.

Next month: Operation and calibration.

. . . K2OAW



Pc board with components.

Bill Hoisington K1CLL
c/o 73 Magazine
Peterborough NH 03458

RF Feedback, The Experimenter's Curse

There is a particularly nasty form of trouble which can afflict solid state transmitters, and multi-rf stage receivers too, much more than the old-fashioned tube jobs, and considerable attention must be paid in order to avoid it. This is interstage coupling through the low impedance power lead connections and wires, which ordinarily with tubes would not allow sufficient rf voltage to be sent from stage to stage to cause much trouble.

Even with tubes, precautions against this type of trouble had to be taken at times, especially as one went higher and higher in frequency up into UHF. One of the bad features about it is that it can happen easily enough between a first stage and a last stage, transforming one millivolt into one volt and causing violent reaction.

Very complicated power lead filters have been devised for this deal, as for example eight and sixteen section filters for an eight tube radar i-f strip.

Ceramic feedthrough bypass capacitors were designed for use where power leads went through partitions, which cut down the nuisance rf voltage to a certain extent, enough for the tube type sources, exciters, and finals, if sufficient care and shielding was used in the overall design. Some of these ceramic feedthroughs work at 432 and some do not, as you will see.

Now we are faced with devices (transistors) which exaggerate this kind of trouble due to very low rf impedances. Some transistor collector circuits operate with impedances of less than ten Ohms, and for high power it may go under an Ohm. This means that a bypass, that was good at 432 MHz with tubes, may let through rf voltage at low impedance, driven by those high current solid state devices to couple back from the final right past a "bypass" capacitor and into the exciter and knock it right out, subject to the phase involved. Or worse, throw the stages into self-oscillation, because the input of these devices is also low and so operates on very small voltages of just the kind we're talking about. This is further aggravated if low cost devices are used in the first stages because then the low level operation is more subject to feedback.

Say you've got a gain of 10 or 12 in each of two rf stages, the last one putting out one or two hundred milliwatts, and you couple back just one percent along the battery leads to a tripler stage with an output of only one or two milliwatts. You see what can happen? And it does, too! Not only that, but if it just happens to be in phase, you get output even when you pull the crystal out, and that is about the worst thing that can happen to any transmitter.

So it will pay to examine this question in detail, because as amateurs we have an obligation as well as the need to develop our skills in the art, and this subject is a basic one for all types of transmission and reception by solid state devices.

With this in mind, I started in on the power lead filter deal with the goal being a small low-cost unit easy to make, with at least 40 dB of attenuation in voltage, if possible. It turned out that it was.

These tests and the final low cost filters are good for receivers also. A contemporary author in another magazine I happened to be reading recently mentioned, "You'll have an easier time with one rf stage than with two." No argument there at all. Just that these tests and filters should help reduce the effort needed to "tame" two rf receiver stages, as well as multi-stage transmitters.

How to Get "Cold" Connections

Most of our work on UHF calls for hot wires, that is, wires carrying plenty of rf, and losing the least amount possible through insulation losses, radiation, wire resistance, or by any other nuisance method. For power leads we want just the opposite, to carry dc and lose all the rf immediately. Or at least so much that you can neither detect it, nor find any nuisance effects, which amounts to the same thing. An oscillator and rf amplifier will do for the source and a tuned diode detector will do the job of measuring. After all, we're not doing a research job for a capacitor company, we're just interested in learning how to put a solid state transmitter on the air with a good stable signal without touchy feedback, connectors that jump rf-wise, and other transmitting plagues. The same holds for the multi-stage receiver also.

Fig. 1 shows a test set-up that can tell us what's what in this matter. After all, if I do it and tell you about it, that gives you more time to build things and get them on the air.

At "A" we have a good 20 milliwatts at 432 MHz coming onto the test plank. At "B" we have another cable going to the tuned diode detector, and with the units shown the meter reads four volts dc when "A" is connected to "B."

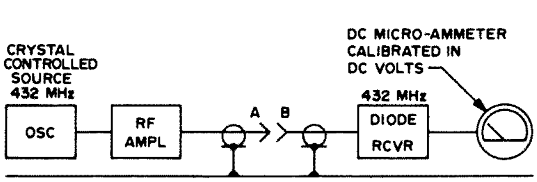


Fig. 1. Test setup, power lead filters.

The trick is to connect "something" between A and B that will carry heavy current 12 volts dc with only a small drop or none at all. This may mean a thin wire choke, or a resistor for a low power first stage drawing only 10 or 20 mils, and it may mean later a heavy wire choke for 12 volts at one quarter of an Amp for a three Watt final.

Tests

Referring to Fig. 1, all results are given in dc volts at the output of the diode detector:

Coaxial cable A to B, 4 volts; piece of wire on the ground, 3.5; piece of wire with 1000 pF to ground at B, .3; 1000 pF at A, .29; 1000 pF at A and B, .04 (40 milliwatts); 100 Ohm resistor between A and B, .042; with 1000 pF at A and B, plus 100 Ohms between A and B, zero volts. This could be used with a low current stage like a receiver where even down to six volts is all right for low noise rf, but let's keep going. You certainly couldn't modulate a solid state final through a 100 Ohm resistor.

Choke coil between A and B, no. 40 wire, ¼" diameter, length ½", no capacitors, .2; with 1000 pF at A, .01 volts; with 1000 at A and B, ½ mV. Beginning to look good.

10 turns no. 34 wire, 20 mV, showing that the choke question is subject to variations in filter power, in this version.

Yellow surplus choke, 1 mV, good but not quite the ideal yet. Ten turns on the choke and 1000 dipped mica at A and B, 10 mV. Same, with small 3/16th Lafayette ceramics, 3 mV.

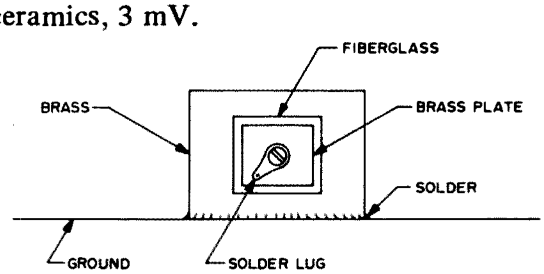


Fig. 2. Simulated, flat coaxial filter.

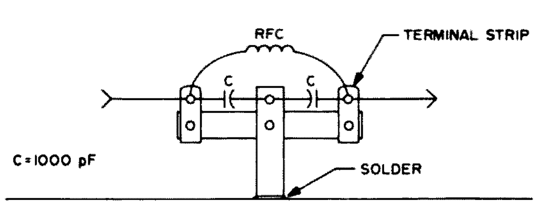


Fig. 3. Filter module.

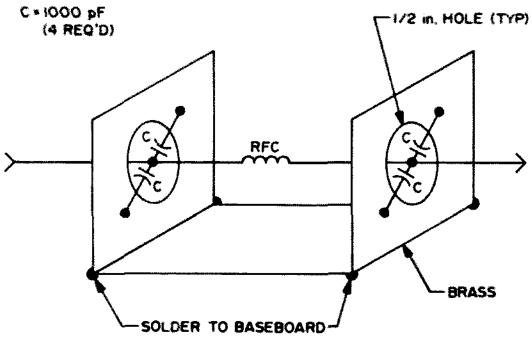


Fig. 4. Brass frame module.

Home-brewed flat coax, as in Fig. 2, 10 mV; two 1000 pF at A and B, plus 20 turn choke, 1 mV. At this point I thought about a small module as in Fig. 3. The meter hit the pin. Bringing the two capacitors to *one* connector, which had some inductance to ground, was absolutely N.G.

I then cut out a small brass frame as in Fig. 4. Hurray! The first time to hit a real zero volts. It makes you haul out the ohmmeter and check for a short or an open! Same, but without choke, also zero.

I noticed that every time I checked with another 1000 pF on a little coffee stick from A or B to ground, in effect paralleling the one already there, the meter plunged to near zero. At 432 MHz this is the same thing you may have read about more than once in my articles. More than one capacitor at the same place. It parallels the inductance and drops it.

Now we're getting close to the ideal; in fact, to cut it short, Fig. 5 shows the ideal. No brass plate is needed, and you can use it either on the baseboard or with the choke-resistor installed in a hole in a box wall, or what have you.

The two-section filter, using 4 capacitors plus a choke in between, really does the job. You imagine the meter moves, maybe. There might be somewhere between 1/10 and 1/100 of a millivolt of rf leaking through, and some or all of this may be "jumping" through the air.

So now you can make up units in advance, as in Fig. 5, and be sure they'll work at 432 MHz.

30 pF Capacitors

Just for fun, another two-section filter was assembled, as in Fig. 5, but with the low

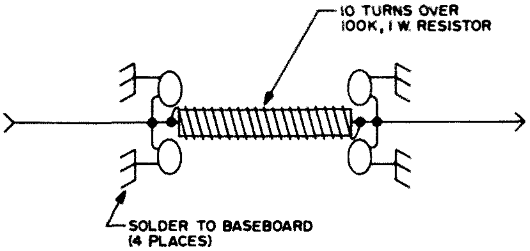


Fig. 5A. Ideal low-cost power lead filter, top view.

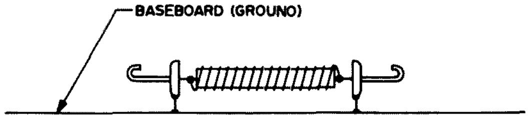


Fig. 5B. Side view of power lead filter.

value of 30 pF for each of the four capacitors. Of course at 432 MHz the rf impedance of 30 pF looks almost like a dead short, and it was. I could not tell the difference between the 150 pF filter and the 30 pF one. This makes it easy if you have large quantities of surplus dipped mica capacitors of odd values.

The reduction in rf voltage is something like 50 dB, dropping from four volts down to about 1/100,000 of a volt. This is plenty for power and lead filters. The cost in parts is that of four capacitors at around 10 cents each, and a resistor for a coil form.

"Boughten" Feedthrough Capacitors

The first ones tried were disappointing. The type "FT," shown in Fig. 6, allowed 20 mV to leak through.

I did dig up a couple of good ones out of a 1946 surplus UHF Navy unit. I suspect that the price will be quite high on such units, if they can be found. These

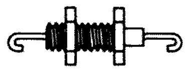


Fig. 6. Type "FT" feedthrough capacitor.

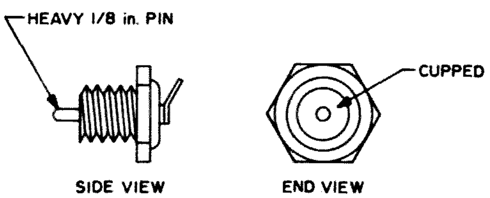


Fig. 7. Feedthrough capacitor.

look like Fig. 7, and perhaps some reader from the sales department of Sprague or Centralab or Erie can tell me what they are, and for how much they go to amateurs interested in good UHF feedthrough bypasses. They do seem to work as well as the final form shown in Fig. 5, so if you can find them, pay the price, and have a wall to put them in, such as in an enclosed rf stage, you can use them.

Subminiature Filters

The test setup of Fig. 1 being in operation, a smaller version was tried, to be ready for the size reduction being looked forward to with all kinds of new and exciting very small conponents becoming available on the market.

As long as 30 pF capacitors worked well, anything over that would naturally be all right, so with a 1/10 Watt resistor for the choke coil form, away we went.

While this is not as small as can be made today, when you get into chips and hybrids, prices go in an inverse ratio. Little 1/8 inch by 1/8 inch by 1/16 inch square Lafayette ceramics cost around 13 cents, so we still can call this one low cost.

The assembly is just the same as in Fig. 5, with the total space occupied being 1/2 inch long by 5/8 inch wide by 1/4 inch high, and, as mentioned, it could be cut down even more if you tried.

It worked just the same as the larger one in Fig. 5. Need I say more?

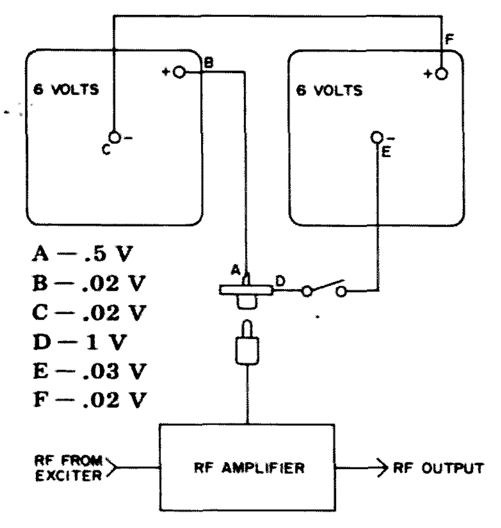


Fig. 8. Test results, rf on batteries and leads.

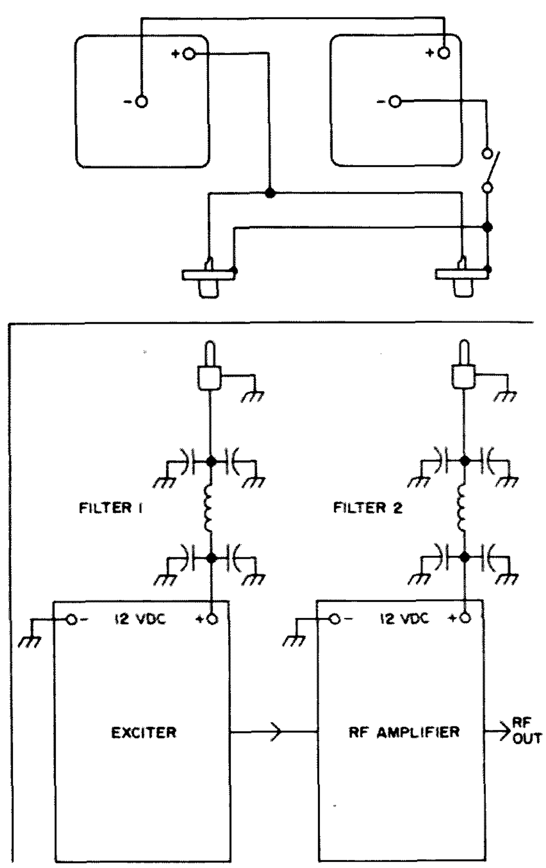


Fig. 9. Battery lead filters.

Checking Out the Filter

Fig. 8 shows the results of tests conducted on a crystal-controlled exciter and rf final destined for use in the 432er Solid State assembly. Note the one volt of rf at test point D *without* the filter. At the same point, also without the filter, about a tenth of a volt was found with only the exciter fired up. See Fig. 9. You can see what that kind of rf path will do for feedback from a quarter Watt or a 1/2 Watt final.

So a piece of copper-clad was put down under the two units as shown in Fig. 9 and the two filters installed. Perfect! No rf could be detected at all at any place on the batteries. Note that *two* filters are now present across any feedback path through the batteries and their leads.

There still exist possible voltage field and magnetic field feedback paths between the rf final and the exciter, but that's another story. The battery lead feedback path is now eliminated. And at least one thing shows up in favor for the solid state devices. There is only *one* wire in which to put a filter!

. . . K1CLL

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Surveying the DVM Scene

Do you remember when a single CK-722 cost five dollars, or for that matter when one decade counter cost about ten? If you, like most of us, can remember those prices and what they are today, you can appreciate the growth and acceptance of the digital vom, or DMM.

Digital multimeters as opposed to conventional analog-metered devices offered several distinct advantages and until recently, one disadvantage. On the "plus" side of the ledger: accuracy, simplicity and lack of parallax. On the "minus" side, cost frequently in the range of about four hundred dollars.

Why should a digital meter cost so much more than a conventional meter, or more accurately, why did it cost so much more? Until recently, costs of digital display devices priced the DMM out of the reach of hams and confined it to the R&D laboratory bench. However, with the pocket calculator boom, the cost per digit of display dropped dramatically from around ten-dollars per digit to around a dollar a digit.

If we were to attribute one singular advantage to the DMM over the analog meter it would be simplicity. Due to different viewing angles it is possible to get several values from a given analog meter reading (that is, assuming the meter hasn't been dropped or driven off-scale and pegged). This duplicity is known as parallax. However, with the digital display, we deal with absolutes. For example, "125", regardless of what angle we view these three digits, will read "125".

Terms

Digital meters use a set or two of terms unique to themselves, and it behooves the smart shopper to understand them and that to which they refer (usually some magnitude of $$ over the competition).

Accuracy, as: ± 2% ±1 Digit – The reading (basic) will be accurate to within ± 2% ± the least significant digit, e.g. E in = 100 V ± 2% – displayed as 98 or 102, ± 1 digit = Readout 103- -101 Or 99-97.

Display, as: 3½ Digit – For reasons of economy, the most significant digit will display either Ø or 1, so:

2½ Digit displays – 199 Max
3½ Digit displays – 1999 Max
4½ Digit displays – 19999 Max
BUT
4 Digit displays - 9999 Max

Auto-polarity: Voltage and current will be displayed with the proper polarity prefix automatically, without the need to reverse leads or flip switches.

Auto-ranging: Automatic display of voltage and current within the capabilities of the device with no need to utilize a range switch.

Selecting A DMM

Buying your first DMM is alot like buying a car, stereo or for that matter, taking a mistress. Obviously you get what you pay for. Are you going to use this unit only on your bench, or will you be climbing towers with it? If you can be satisfied to be bench-bound you can get a model with ac only operation. If you choose to "fly" select one with capability for dc as well as ac operation. How many digits are enough? How accurate do you want to be, keeping in mind that most voltage and resistance measurements on schematics were taken by a trusty, oft-dropped 20kΩ/volt VOM. Do you want to read current to the pico-Amperes?

Many people feel that it's cheaper to build than to buy; with today's market place

that remains to be seen. The lowest priced DMM fully assembled, calibrated, etc., is $170.00 as opposed to the least expensive kit DMM at $79.00, but for that extra few bucks you lose an extra ¼ digit and get full calibration and the ability to meter current. The choice is yours, but remember, your meter will only be as accurate as your calibration sources.

Survey

The following survey/buyer's guide represents major and minor manufacturers of DMM devices. Prices listed are current, but the reader should beware of Murphy's Law Sub-Section XIVa, which states, ". . .if a price can go up, *it will most assuredly* and following closely the publication of a buyer's guide. . .".

Manufacturer	Model	Price	Wired/Kit	Power Source	Digits Displayed
Ballantine	3/24	195.00	W	DC/AC*	3
B-K Precision	281	170.00	W	AC	2 ¼
B-K Precision	282	200.00	W	AC	3½
DanaMeter	2000	195.00	W	DC	3½
Data Precision	134	189.00	W	AC	3½
	245	295.00	W	AC/DC	4½
Data Technol.	21	269.00	W	DC/AC*	3½
Digi Tec	2110	219.00	W	AC/DC	3½
	2120	275.00	W	AC/DC	3½
Fluke	8000A	299.00	W	AC	3½
Heath	IM-1202	79.95	K	AC	2½
	IM-102	239.95	K	AC	3½
Hewlett-Packard	970A	275.00	W	DC/AC	3½
Hickok	334	229.00	W	AC	3½
Keithly	168	299.00	W	AC	3½
	168	359.00	W	AC/DC	3½
Non-Linear Sys	LM-4	187.00	W	AC	4
Simpson	360	295.00	W	AC/DC	3½ + Analog Mtr
Tekelec	357	179.00	W	AC	3½
Weston	4448 under	300.00	W	AC	3½
	4449 "	"	W	AC	3½
	4440 "	"	W	DC	3½
	4442 "	"	W	DC	3½
	4443 "	"	W	DC	3½

Legend:

(*) Optional (Additional Cost Item)

DC - Battery operation

DVM Manufacturers & Addresses

Ballantine Laboratories, P.O. Box 97, Boonton NJ 07005
B-K, Div Dynascan, 1801 Bell Plaine, Chicago IL 60613
Dana Laboratories, 2401 Campus Dr., Irvine CA 92664
Data Precision Corp., Audubon Rd., Wakefield MA 01880
Data Technology, 2700 Fairview, Santa Ana CA 92704
DigiTec, 918 Woodley Rd., Dayton OH 45403
John Fluke Co., P.O. Box 7428, Seattle WA 98113
Heath Co., Benton Harbor MI 49022
Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto CA 94304
Hickok Elec. Instr. Co., 10514 Dupont Ave., Cleveland OH 44108
Keithly Instrument Co., 28775 Aurora Rd., Cleveland OH 44139
Non-Linear Sys., P.O. Box N, Del Mar CA 92014
Simpson Electric Co., 853 Dundee, Elgin IL 60120
Tekelec Inc., 31829 La Tienda Dr., Westlake Village CA 91361
Weston Instruments, 614 Frelinghuysen, Newark NJ 07114

. . . **W9KXJ**

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How About a Weather Satellite Monitor?

In a series of previous articles in 73 (Sept. 74, Dec. 74, and June 75), I outlined a number of circuits and techniques that could be used to display weather satellite pictures on conventional SSTV monitors. My correspondence in regard to these articles indicates that there is a widespread interest in copying weather satellite pictures and, as one might expect, the interest is not confined to individuals who are active in SSTV. The volume of mail clearly indicated the desirability of a simple monitor circuit designed specifically for weather satellite service, and this article will describe such a project.

The circuit is simple, yet incorporates some of the latest circuit ideas which I have developed in experimenting with this interesting mode. In addition, printed circuit

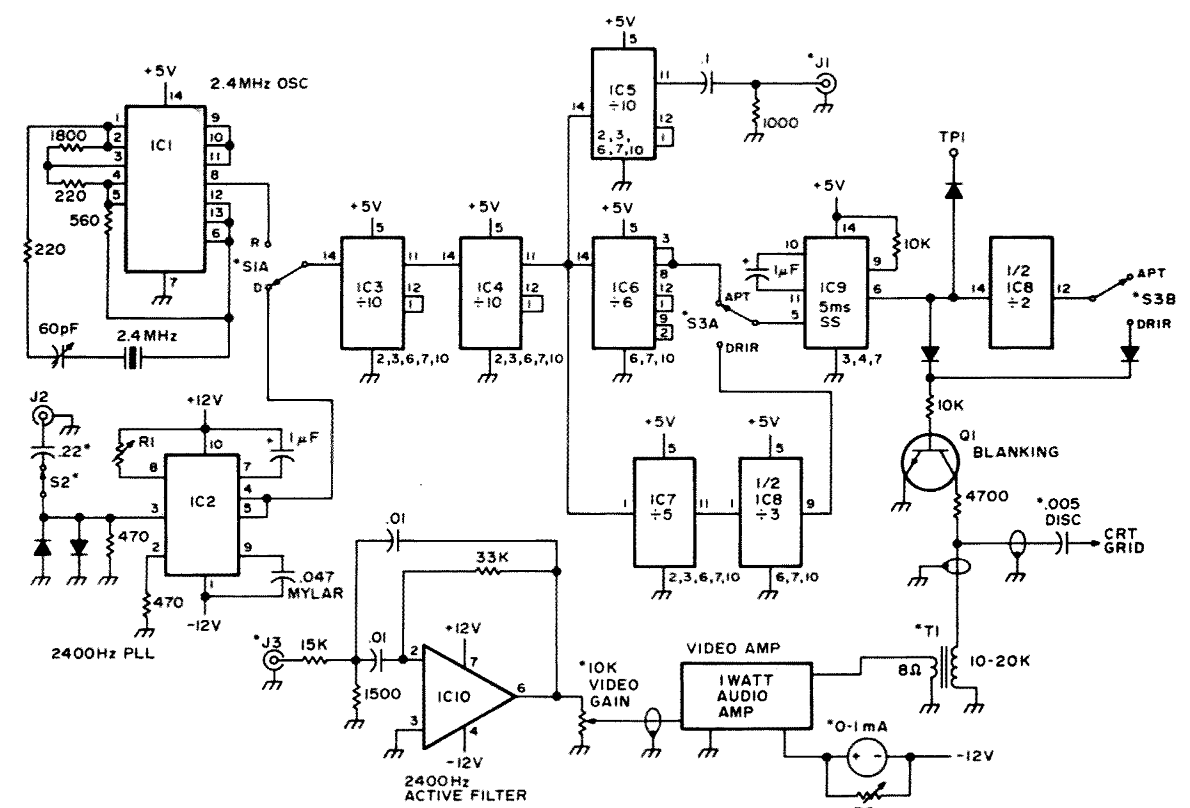


Fig. 1. Unless noted, all resistors are 1/4 or 1/2 Watt, 10%. Capacitors are mylar, disc, or electrolytic (polarity marked) as noted. Unmarked diodes are general purpose computer or switching types (1N457, 1N914, etc.). R1 — 5k pc pot, VCO frequency control. S1 — DPDT toggle, receive (R) or display (D). S2 — normally closed push-button, phasing. S3 — 4 pole 2 pos. rotary, APT/DRIR mode selection. Components marked with an asterisk (*) mount on the chassis, all others are on board #1. IC1 — 7400, IC2 — NE565 PLL, IC3, 4, 5, 6, 7 — 7490, IC8 — 7492, IC9 — 741 op amp. T1 — output transformer, 10-20k to 8 Ohms. Rs — 50 Ohm pot, adjustable meter shunt (see text). J — RCA phono jack; J1 — 2400 Hz to left channel input of tape deck, J2 — to left channel output of tape deck, J3 — satellite video from right channel output of tape deck. Q1 — HEP712.

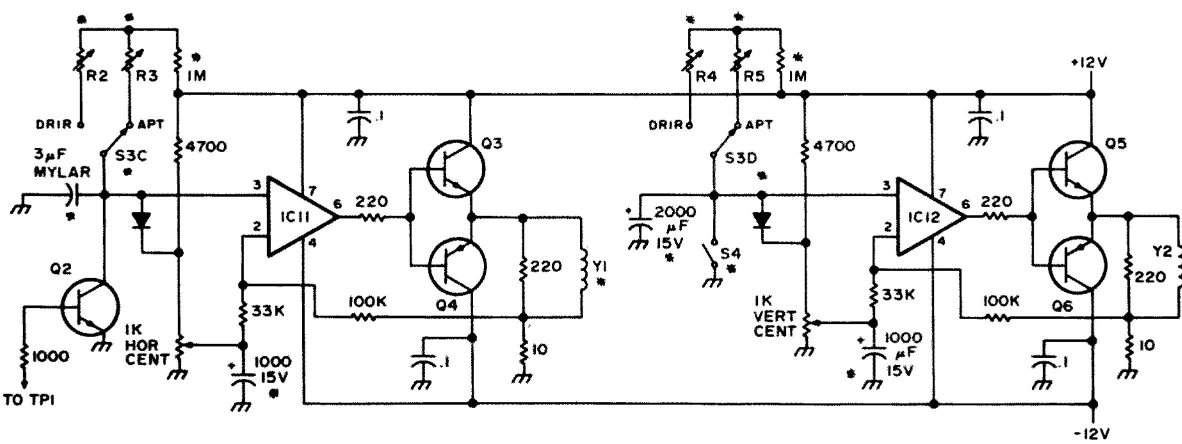


Fig. 2. Deflection circuit (board #2). General component notes as in Fig. 1. Q2 – HEP55. Q3, 5 – HEP 245. Q4, 6 – HEP 247. IC11, 12 – 741 op amp. Y1 – horizontal deflection coils, Y2 – vertical deflection coils; both coils incorporated in standard TV deflection yoke (Stancor DY-2A or equiv.). S3 – see Fig. 1. R2 – 1m DRIR hor. size. R3 – 1m APT hor. size. R4 – 1m DRIR vertical size. R5 – 1m APT vertical size. S4 – SPST toggle, close to reset vertical sweep, open to run. Components with an asterisk (*) mount off the board, all others mount on board #2.

board layouts were developed for the active circuits and are included here to make the project even easier to tackle. Virtually all of the circuit components, with the exception of switches, controls, and power supply, mount on two small circuit boards, permitting complete flexibility in packaging the final unit. In the course of development, the original circuits were modularized into a number of units that interface with my own station, which uses a variety of CRT and facsimile techniques, but the same boards can be incorporated into an extremely compact CRT monitor for multi-mode weather satellite display. Multi-mode capability is required, since some satellites use the older APT picture transmission system (the polar orbiting ESSA 8 and the geosynchronous ATS satellites) while the current NOAA satellites utilize the time multiplexed DRIR mode that permits simultaneous transmission of both visible light and IR picture data.

The technical details of the video format of the two modes will not be covered here. Ideally, the sync system of the monitor should be independent of the condition of the satellite signal for maximum reliability. This is achieved by generating a 2400 Hz sync reference tone that is recorded simultaneously with the satellite picture, requiring the use of a stereo tape deck. Any tape format (reel-to-reel, cassette, or 8 track cartridge) may be used with the system. In addition to the recorder, a VHF receiving system will be required to complete the satellite receiving station. A low noise FM receiver with a 15 kHz i-f and crystals for 135.6 (ATS), 137.5 (primary NOAA), and 137.62 (ESSA 8 and backup NOAA) will put you in business.

Circuit Description

The basic functions provided by the monitor circuit are listed below:

1) During reception of a satellite signal, generation of a crystal controlled 2400 Hz reference signal which is recorded on the left channel of the tape deck while the satellite signal is recorded on the right channel. This tone serves as the sync reference signal during picture display.

2) Video filtering and amplification of the satellite signal, and Z axis modulation of the monitor CRT.

3) Switch selection of either the APT or DRIR display modes with appropriate sync count-downs and pre-set size and centering for both modes.

Conceptually and physically the monitor is broken down into four sub-assemblies:

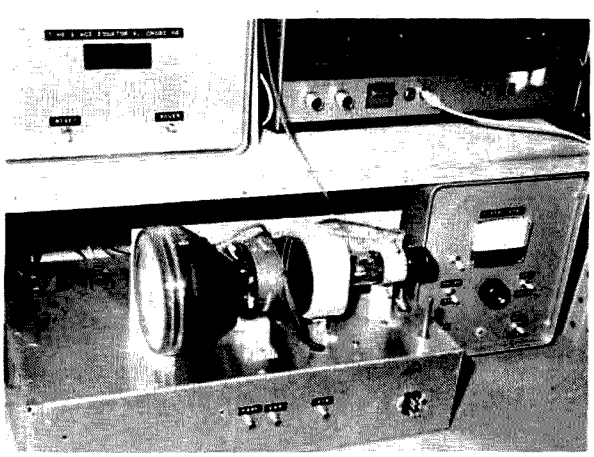
1) Video and sync processing – board #1.
2) Deflection circuits – board #2.
3) The CRT and associated controls.
4) The power supply.

Video and Sync Processing (Fig. 1)

These circuit elements are included on board #1 and control the generation of the 2400 Hz reference tone, appropriate division circuits to generate either 4 Hz (APT) or 1.6

Hz (DRIR) trigger pulses for horizontal triggering, and satellite video filtering with additional amplification provided by a small transistorized amplifier module. In order to limit circuit complexity, several of the devices on board #1 are used for both receive and display functions. S1 is used to set either of these two conditions. In the receive mode only board #1 is operational, to reduce power consumption. With S1 in the receive position, IC1 functions as a 2.4 MHz oscillator whose output is divided by 1000 (IC3, 4 and 5) to provide the 2400 Hz reference tone at J1. This tone is recorded on the left channel of the station recorder as the satellite signal is recorded on the right channel.

With S1 in the display position all of the monitor circuits are functional. The reference tone recorded on the left channel is routed to J2 where it locks up IC2, which functions as a 2400 Hz phase locked loop, tracking any small variations in the reference signal due to recorder speed variations. S2 in the input circuit to IC2 functions to unlock the PLL for picture phasing. The 2400 Hz output of the PLL is routed through S1 to a series of digital frequency dividers. The



Modular units used to develop the satellite monitor. The large chassis contains the CRT, deflection yoke, and the HV module. The cabinet with the meter contains the two circuit boards and the power supplies. If the unit were constructed in a single cabinet it would be possible to package it in a cabinet about the same size as that for the electronics package. Such as integrated unit should have the power supply located remotely to eliminate 60 Hz trace distortion in the CRT.

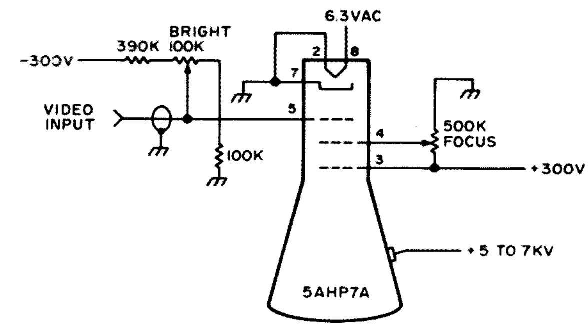


Fig. 3. CRT and associated control circuits. Fixed resistors are 1/2 Watt, brightness and focus pots are 2 Watt composition pots.

division sequence is controlled by two sets of contacts of the mode switch (S3). In the APT mode the 2400 Hz signal is divided by 600 (IC3, 4 and 6) to produce a 4 Hz square wave. In the DRIR mode the 2400 Hz is divided by 1500 (IC3, 4, 7 and ½ of IC8) to produce a 1.6 Hz square wave. The appropriate square wave output of the division sequence is routed to a 5 ms single shot (IC 9) which provides a short TTL pulse to trigger the horizontal deflection. This trigger pulse is routed to TP1 and also to the base of Q1, where it provides for retrace blanking of the video signal. Since the DRIR video format consists of alternate lines of visible and IR picture data, it is necessary to blank alternate lines of video in the DRIR mode to assure display of either visible light or infrared (IR) pictures. This is accomplished by routing the trigger pulse to ½ of IC8, which functions as a flip-flop, turning on the blanking transistor (Q1) on every other video line.

Video processing is straightforward yet effective. The satellite video from the right channel of the tape deck is routed to J3 and through a 2400 Hz active bandpass filter. This filter has a bandwidth of 1000 Hz and unity gain. A sharper filter would reduce noise in the IR channel (video bandwidth of 450 Hz) but would degrade resolution in the visible channel (bandwidth of 900 Hz). Further video amplification is provided by a small transistorized amplifier available from Radio Shack. Any small 1 Watt amplifier would do equally well. A meter with an adjustable shunt, in the power lead to this amplifier, serves as a video level indicator. The output of the amplifier drives T1, which

boosts the signal to a voltage sufficient to drive the CRT grid. The blanking transistor (Q1) shorts out the video for the duration of the trigger pulse in either the APT or DRIR modes and on alternate lines in the DRIR mode to provide retrace and alternate line blanking.

Deflection Circuits (Fig. 2)

The deflection circuits are an adaptation of widely used SSTV deflection circuits and provide highly reliable performance. The horizontal trigger pulse from TP1 of board #1 turns on Q2 for the duration of the pulse, shorting out the 3 mF horizontal discharge capacitor. When Q2 goes off at the end of the trigger pulse, the 3 mF capacitor begins to charge through either the APT or DRIR size controls, depending upon the setting of the mode switch (S3). This voltage ramp drives an operational amplifier (IC11) which in turn drives a pair of complimentary power transistors (Q3 and 4) with the horizontal deflection yoke in their common emitter circuit. Centering of the horizontal trace is accomplished by feeding a variable voltage into the non-inverting input of the op amp. A single setting of the centering control is used for both the APT and DRIR modes.

The vertical deflection system operates in a similar manner except for the time constants of the discharge circuit and the fact that the vertical deflection system is cycled manually with a switch rather than a transistor. The 2000 mF vertical discharge capacitor is shorted out by S4 to initiate the vertical sweep. When S4 is opened the capacitor begins to charge through either the APT or DRIR size control. The ramp voltage drives another op amp (IC12), which in turn drives the deflection transistors (Q5 and 6). The centering system for the vertical deflection is identical to that used in the horizontal circuit.

CRT Control Circuits (Fig. 3)

The 5AHP7A CRT is operated in a grounded cathode mode with the video signal applied to the grid. Adjustable grid bias is supplied by the brightness control to set the trace so that it is just below the

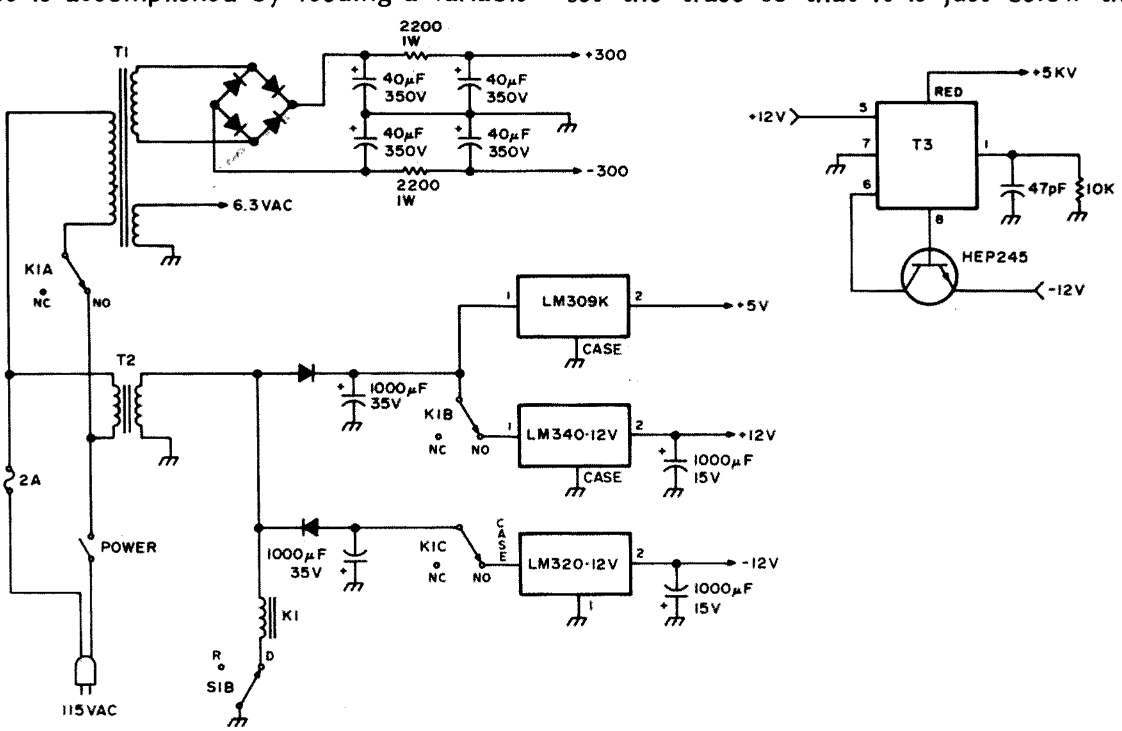


Fig. 4. Power Supply. All unmarked diodes are HEP 170. T1 – Stancor PC-8401 (470 Vct 40 mA, 6.3 V 1 A). T2 – Stancor P8357 (24 V 2 A). T3 – Stancor H0-409 flyback. The power switch can be located on the monitor brightness control to control the supply. Suggested: Cinch Jones P-310-AB plug on monitor chassis, S-310-CCT on power cable; 1-ground, 2-6.3 V ac, 3-+5 V, 4-+12 V, 5- -12 V, 6- +300 V, 7- -300 V, 8- line from S1B, 9- common ac, 10- switched ac. K1 – 3PDT 24 V ac relay controlled by S1 (receive/display) on monitor; only the +5 V circuits are operational in the receive position while the entire monitor functions in the display setting.

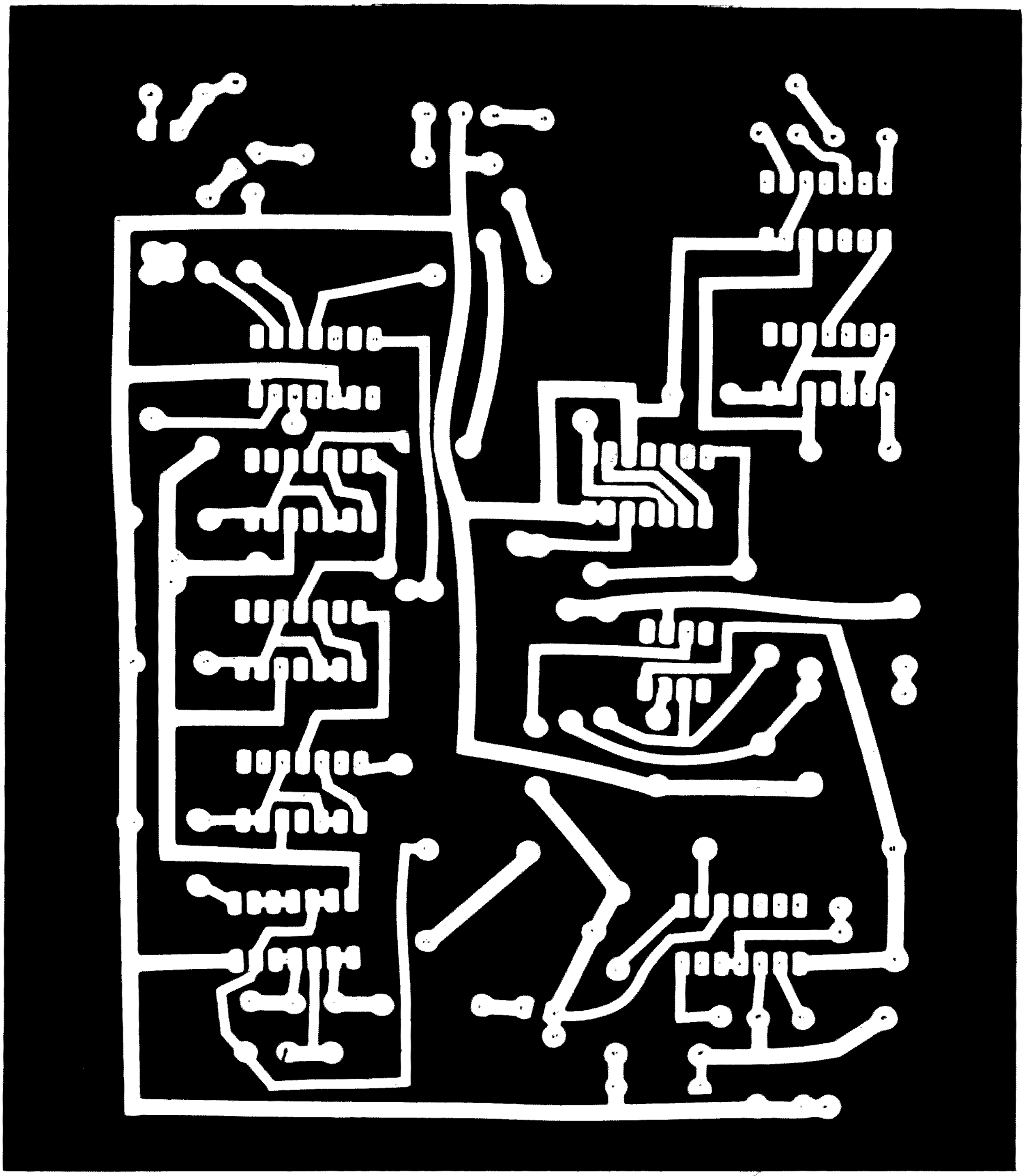


Fig. 5(a). PC board #1 (full size).

visibility threshold in the absence of video. The component values in the brightness circuit are chosen so that the video output from T1 is not loaded excessively by the grid circuit. The 5AHP7A is electrostatically focused, as indicated in the schematic. The 5FP7, which is commonly available on the surplus market, may be used with two modifications. The focus pot may be eliminated but either a permanent magnet or electromagnetic focus coil must be used. The long persistance of the P7 phosphor enables many details of cloud cover to be evaluated as the image is being photographed. With some modification of circuit values and pin connections a number of the small P4 tubes used in solid state TV circuits could also be used, but they would not have the long persistence feature. Since detailed evaluation of cloud and terrain features is best accomplished with photographs of the CRT image, this is not a great drawback – and a great

Full size negatives for Fig. 5(a) are available for $2.00 each from PC NEGS, 73, Peterborough NH 03458. Order #WB8DQT-1.

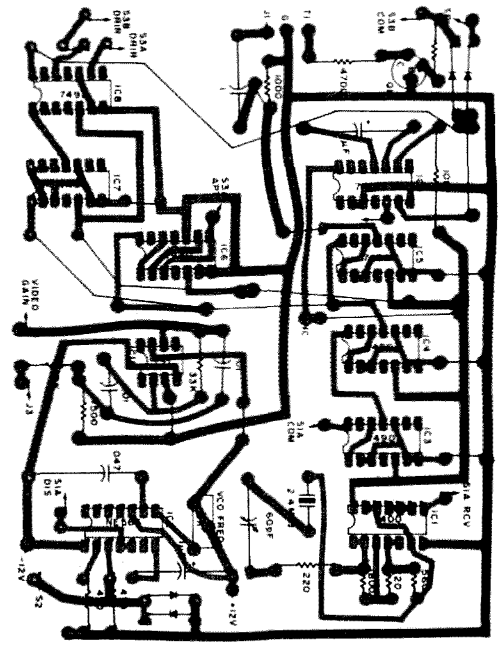


Fig. 5(b). Parts layout for board #1.

many of the small TV tubes are quite reasonably priced.

Power Supply (Fig. 4)

The power supply is strictly conventional and any variations that would provide the proper voltages and regulation would work well. The HV module for the CRT is a simple transistor oscillator working into an unmodified TV flyback transformer. The basic supply should be remoted from the monitor to prevent 60 Hz distortion of the trace, but the HV module should be mounted close to the CRT so the HV connector from the flyback (which includes the HV rectifier assembly) can reach the appropriate connection to the shell of the tube.

Construction

Fig. 5 shows the printed circuit foil pattern and component layout for board #1 while Fig. 6 provides similar data for board #2. If the component placement figures are followed carefully no problems should be encountered. Packaging of the completed boards with the CRT can be accomplished in virtually any enclosure that will hold them. The following controls and indicators are

operational controls and should be mounted where they are accessible: S1 (receive/display), S2 (phasing), S3 (APT/DRIR mode selector), S4 (vertical sweep), brightness, the video gain control, and M1 (video level). The focus control and deflection size controls are "set and forget" features and can be located anywhere. Although not required, the use of IC sockets for the circuit boards is highly recommended as removal of a bad IC can be a chore if it is soldered directly to the circuit board. J1-3 can be mounted on the rear apron of the completed unit. The photo shows the modular packaging used for my own circuit evaluation. Except for the large meter used for the video level control, the whole unit could have been packaged in the cabinet used for the electronics package, had that been the initial goal while the circuits were being designed.

Initial Setup

Prior to connecting the power supply to the completed unit you should verify the presence of the proper voltages and polarity – a mistake here will send you back to the parts store for additional ICs and transistors! Place S1 in the receive position and apply power. Attach a frequency counter to the common lug of S1A and adjust the 60 pF trimmer on board #1 for a frequency reading of exactly 2.4 MHz. This frequency should be set to the maximum resolution of the counter. Move the counter to pin 11 of IC5 – it should read exactly 2400 Hz. Move the counter to pin 3 or 8 of IC6 – a reading of 4000 Hz should be obtained. Set the counter on pin 9 of IC8 and you should get a reading of 1600 Hz. If you've gotten this far you can rest assured that the oscillator and all frequency dividers are operating properly.

Set the counter on pin 4 or 5 of IC2. With no input at J2, adjust R1 for a frequency of 2350 Hz. Temporarily connect a test lead from J1 to J2. The counter should read 2400 Hz, dropping to 2350 Hz when S2 is depressed and rising back to 2400 when S2 is released. Remove the test jumper and turn off the monitor supply.

At this point it is desirable to have a satellite tape for further tests. The satellite video should be recorded on the right

channel. Set the VU or recording level meter for the maximum permissible recording level on receiver noise with no signal present so you will not overload the recorder with the actual satellite signal. J1 should be connected to the left channel input of the recorder. When a satellite signal is heard, verify that S1 is still in the receive position and apply power to the unit. Set the left channel recorder level for 1/3 to 1/2 of the permissible recording level on the 2400 Hz tone, and record the pass.

During playback of the picture the right channel output of the recorder should go to J3 while the left channel output goes to J2. Set the output level of the tape deck to near maximum on both channels. If you are using a recorder rather than a deck, insert pads to keep the levels to J2 and 3 at about 1 volt. Prior to applying power to the monitor preset all controls as follows: S1 – display, S2 – normally closed, S3 – APT, S4 – closed, video gain – minimum, M1 shunt – zero resistance, all centering and size controls – midrange, brightness – minimum (maximum negative voltage on CRT grid), focus – midrange. Apply power to the monitor. After a few minutes for warmup, carefully advance the brightness control until the trace is just visible on the CRT – it should be a horizontal line. If no line is visible, adjust both horizontal and vertical centering to bring it into view. Mask off the largest possible square viewing area on the CRT. Adjust the horizontal centering and APT horizontal size so the line just fills the viewing area from side to side. Momentarily short the collector of Q2 to ground – the trace should form a spot off on the left hand side of the screen. If the trace jumps to the right, turn the unit off and reverse the horizontal deflection leads and repeat the size and centering adjustments after reapplying power. Open S4 and observe the direction of movement of the horizontal line. If the line moves downward close S4 and move ahead in the adjustment sequence. If the trace moves upward, power down, reverse the vertical deflection leads, and reapply power. Set the vertical centering so the trace is just at the top of the viewing area with S4 closed. Open S4 and set the vertical APT size control for a 200 second top to bottom sweep. Switch S3 to the DRIR position and adjust the DRIR horizontal size control for a sweep that extends just beyond the margins of the viewing area. Cycle S4 and set the DRIR vertical size pot for a 7 minute top to bottom sweep. This should be done carefully so the pictures will have the proper aspect ratio.

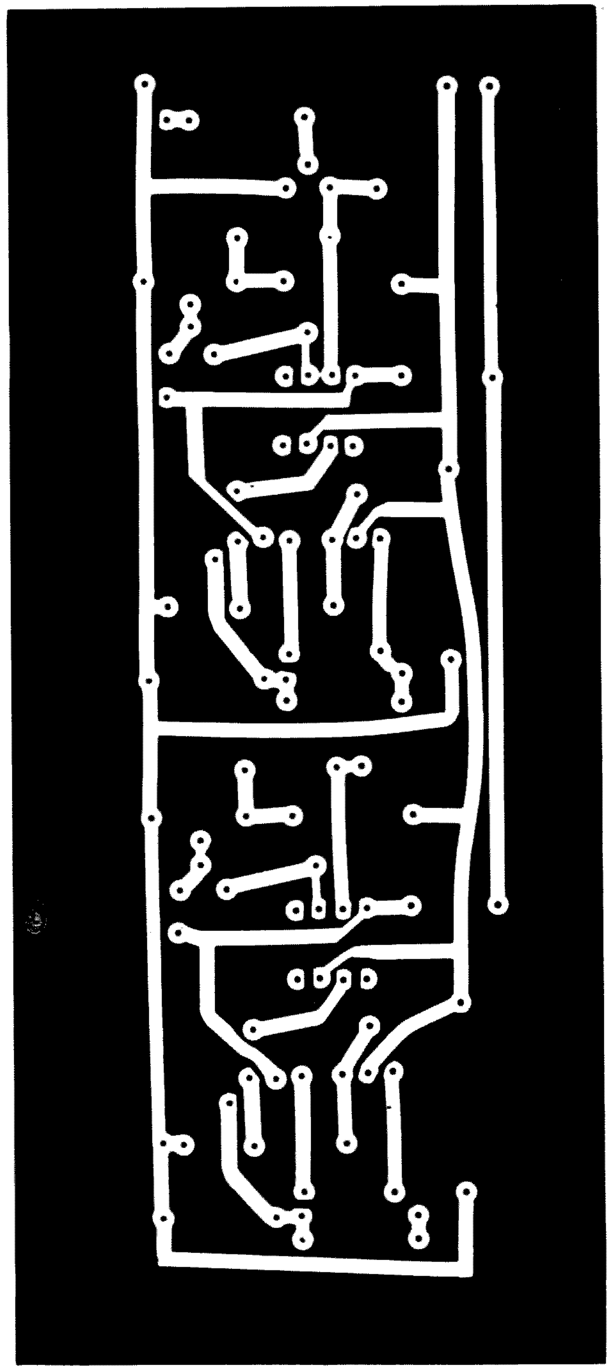


Fig. 6(a) PC board #2 (full size).

If all has gone well to this point you are ready to watch pictures. Back down the brightness control until the trace just disappears in a dark room. Play the previously

Full size negatives for Fig. 6(a) are available for $2.00 each from PC NEGS, 73, Peterborough NH 03458. Order #WB8DQT-2.

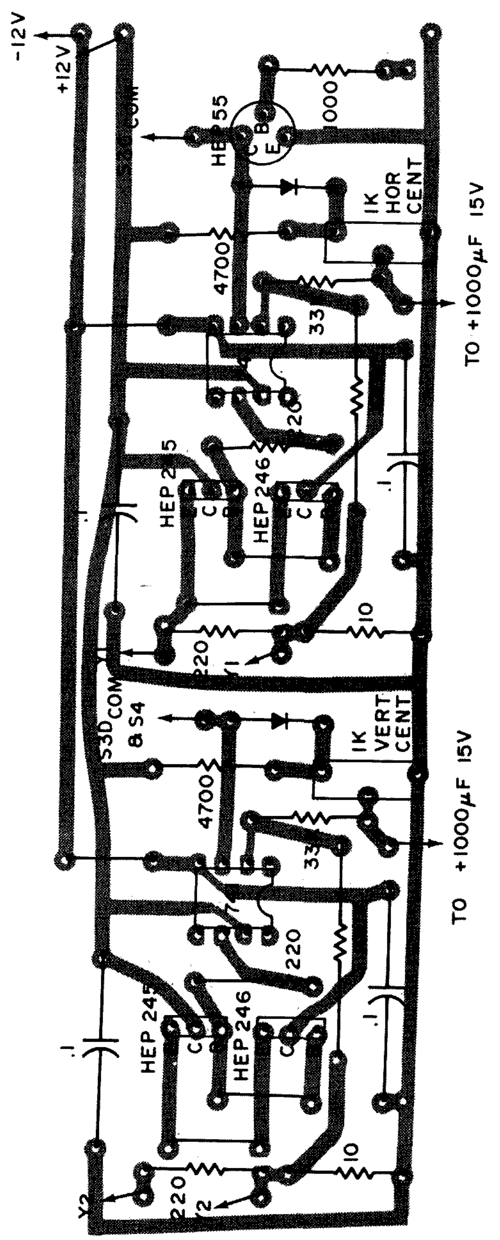


Fig. 6(b). Parts layout for board #2.

recorded satellite tape into the monitor. If your recording is from ESSA 8 or one of the ATS satellites, set S3 to APT. If a NOAA satellite was copied, set S3 to DRIR. Slowly advance the video gain control until satellite video is visible on the CRT. A proper gain setting represents a point showing good whites while still retaining black areas in the picture. It is unlikely that the picture is properly phased at this point. In the case of an APT picture, improper phasing is indicated by the presence of a vertical white bar in the picture area (actually the satellite sync pulse). Press S2 until the bar moves to the left edge of the picture, and release. The APT picture is now properly phased. In normal operation S4 is kept closed during the inter-picture interval (steady 2400 Hz satellite subcarrier) and opened at the start of the picture. Phasing need only be accomplished once during a single pass or picture sequence, as long as the recorder is not turned off. DRIR phasing is used to determine which of the pictures, either visible light or IR, you wish to view. The sync pulse of the DRIR format is a vertical white bar that is actually composed of seven discrete pulses which should be visible if you look closely. Phasing is accomplished by pushing S2 until the bar lines up just off the left margin of the viewing area. In the IR format, the space just after the sync bar will be white while the visible channel view will have a black area immediately following the sync bar. If the picture, as phased, is the wrong channel (the one you don't want at the moment) simply keep S2 depressed and a second sync bar will drift in from the right and move to the left margin. When this one lines up with the left side of the viewing area, release S2 and you are in business with the proper video channel. Both the visible and IR channel of the DRIR format will have usable video during daylight passes while the visible channel will be completely black at night with only the IR view producing usable pictures. As noted in the previous references, the NOAA DRIR format produces a continuous vertical strip of video rather than discrete frames. The geometry of the CRT means that only about seven minutes of this strip can be seen at one time.

Once you are getting reasonable video display you can gradually increase the resistance of the 50 Ohm meter shunt pot. The shunt should be set at a point that gives near maximum meter deflection on video peaks. The meter can now be used for video levels.

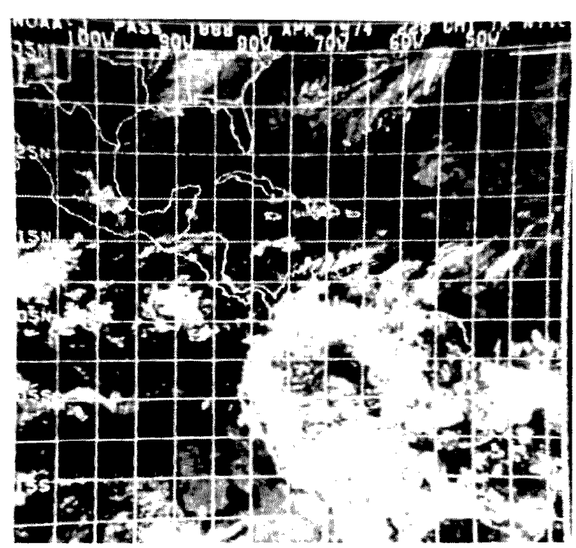
Photography of the weather satellite pictures can be done with virtually any camera that can be focused on the CRT. See the 73 SSTV Handbook for photographic techniques. All photographs should be made in a dark room because of the long time

exposures required. Polaroid type 107 film will give you "instant" weather satellite pictures but gets expensive if you plan to take pictures every day. 35mm black and white film is convenient for taking large numbers of pictures but you are forced to wait until you fill up the roll unless you load your own film in short segments. The advantage of roll film over Polaroid (aside from cost) is that the final pictures can be printed at any size desired. Despite the small size of the CRT, satellite pictures enlarged to 8x10 inches look quite good. Most satellite buffs choose their film and camera on the basis of how many pictures they routinely acquire and the state of their wallets. I use 35mm for day to day operation, keeping Polaroid in reserve for demonstrations. You will probably shoot a lot of Polaroid in the beginning and then phase into other film types as you get into the routine.

I will be happy to correspond on the subject of the satellite monitor but please include an SASE so I have change enough to buy more film!

. . . WB8DQT

Hurricane Carmen battering the coast of Yucatan in September, 1974. The coast and interior of Mexico are faintly visible to the left while Cuba, outlined in sunglint off the waters of the Caribbean, may be seen in the upper right. This picture was transmitted from one of the operational NOAA satellites using the DRIR mode and can be displayed on the monitor. The NOAA satellites transmit a continuous video signal and this segment represents just part of a long picture strip extending from southern Greenland in the north to Panama and western South America to the south.



Gridded NOAA data relayed by the ATS-3 geostationary satellite on 135.6 MHz. Such data, from either ATS-1 or ATS-3, as well as the pictures from the polar orbiting ESSA-8, are transmitted in the APT mode and can be displayed on the satellite monitor.

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The QRP Accu-Keyer

The Accu-Keyer is a low-cost TTL integrated circuit keyer having many features comparable to those of many high-cost commercial keyers. These features include: self-completing dots and dashes, dot and dash memories, iambic operation, dot and dash insertion, and automatic character spacing.[1] The Accu-Keyer was first described in the August, 1973 issue of *QST*. However, that keyer used TTL circuits which are not compatible with QRP operations. The QRP Accu-Keyer is a much needed alternative to the original design.

The QRP Accu-Keyer uses an integrated circuit family known as CMOS. CMOS (also known as COS/MOS by RCA) was first introduced during the middle 60's as an extremely low power digital circuit using complementary-symmetry metal oxide semiconductors. The basic CMOS circuit uses complementary, insulated gate FETs, to achieve extremely low standby power – 10 nW per package for gates. This power feature and moderate cost makes CMOS an attractive logic family to consider for QRP operations, where power is at a premium. This is the philosophy behind the QRP Accu-Keyer.

Design Concepts

Several modifications must be made to the original Accu-Keyer logic in order to incorporate the CMOS family. The basic flip flop design in CMOS differs from that of TTL. The notable exceptions are the set and clear functions. The set and clear functions on a TTL flip flop are inverse logic compared to CMOS functions. CMOS circuits use a logic "one" as a set or reset signal and a logic "zero" as a normal state. This is directly opposite to TTL where a normal state is high and a set/clear command is low. Therefore, it is clear that to convert a TTL logic diagram to a CMOS diagram, all sets and clears must be inverted.

Another difference between the two families is that of supply voltage. TTL requires a rather critical supply source near 5 volts in order to function properly. CMOS, on the other hand, will work properly with any supply voltage between 3 and 15 volts, and the supply regulation is non-critical. This means that the keyer will operate directly from the batteries which power the QRP rig, without any regulation needed. This is an excellent feature of CMOS over TTL.

QRP Accu-Keyer Circuit

Fig. 1 shows the schematic of the QRP Accu-Keyer. There are several differences between the QRP version and the original design. A CMOS astable clock was designed so that discrete components could be held to a minimum. IC8 is connected as a typical astable, producing a square wave output. The output period is equivalent to one time unit in Morse code. Secondly, since the keyer is used with a QRP rig, HW-7 in this instance, the output driver needs to be only a low level transistor switch. This greatly simplifies the output stage of the keyer. Driving a higher power rig would only require the inclusion of a suitable output transistor after Q1. Thirdly, as previously mentioned, all set/clear lines on the type "D" flip flops must be inverted when using CMOS in the original circuit.

Construction

Only eight CMOS circuits are needed for this design. The ICs were mounted in sockets for ease of construction. The sockets were

[1] Garrett, "The WB4VVF Accu-Keyer", *QST*, August, 1973, p. 19.

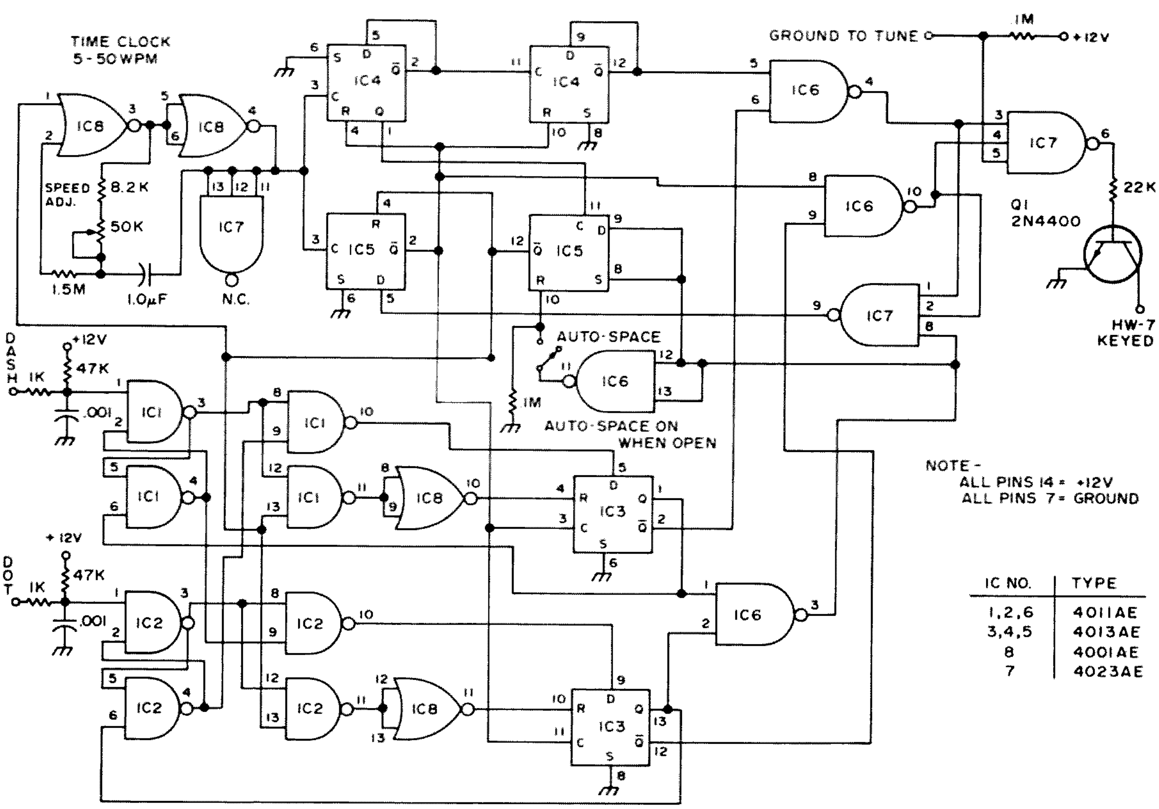
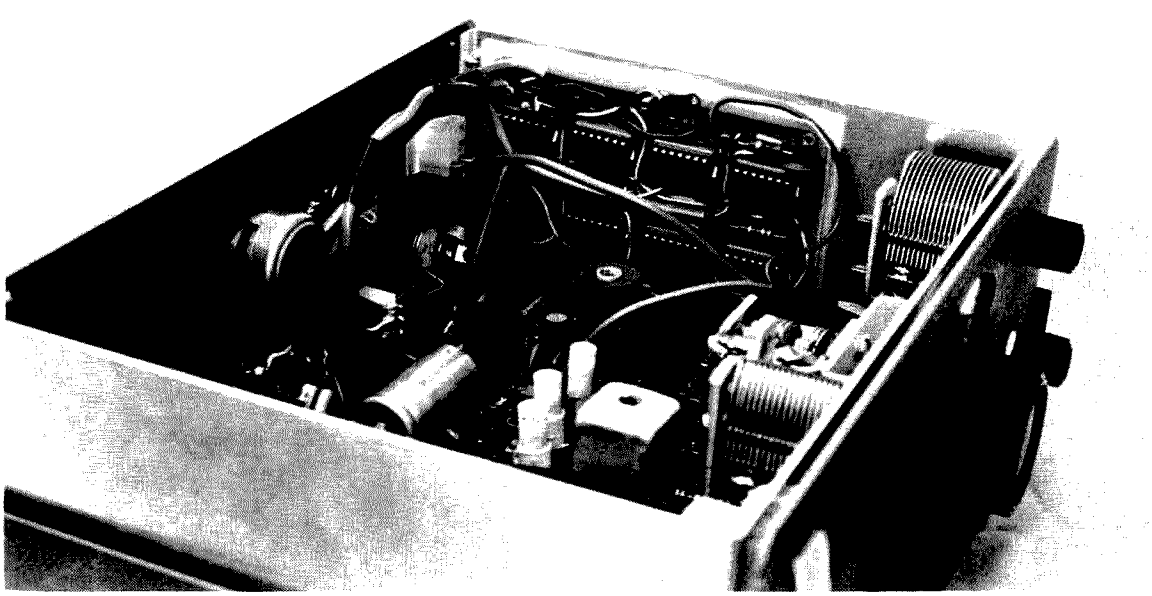


Fig. 1. Schematic diagram of the QRP Accu-Keyer using CMOS integrated circuits. Output transistor is sufficient to drive a HW-7 QRP transceiver. Standby power is less than a microwatt.

first mounted on a perforated board and then hard-wired together with small solid hook-up wire. No special precautions are needed when working with CMOS. However, it is recommended that CMOS not be in the circuit when using a soldering iron with an ungrounded tip. CMOS are now presently being made with diode protected inputs, and



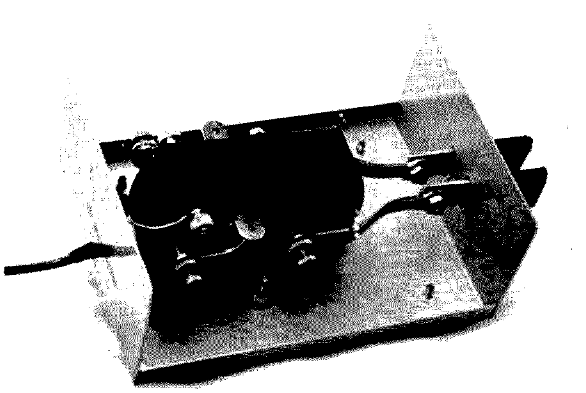
Inside photograph of HW-7 with keyer board in place. Placement of the keyer board is non-critical inside of the HW-7. The associated controls are mounted on the rear panels, as well as a tune button. Three conductor phone jack replaces the usual two conductor jack for the twin paddle key. (Photos courtesy of Robert Baker WA5KVB.)

can usually withstand a limited amount of abuse, but why take a chance? Bypassing the CMOS supply is not necessary because of the excellent noise immunity inherent in the family. The excellent flexibility and ease of design make CMOS a very attractive family to work with.

There may be some question as to the suppliers of CMOS. There are several surplus advertisers who list CMOS. Allied Electronics and Burstein-Applebee also list CMOS in their current catalogues. Generally, the D flip flops are from $1 to $1.50, while the gates are all well below a dollar per package. Although the ICs appear to be more expensive than their TTL counterparts, the power supply requirements and ease of applications should be considered also. There are several nomenclature items which should be stated. The RCA's commercial version of CMOS (4000 series) is listed with the suffix AE, signifying supply voltage of 3-15 volts and commercial specs respectively. The AD suffix signifies 3-15 volts with military specs. The AE version is significantly less expensive than the AD version, and is usually more plentiful on the surplus markets. The 4000 series is the most readily available type of CMOS now produced.

Since this keyer was designed to go with a QRP rig, a HW-7 was a likely candidate. The photo shows the installation of the keyer to the Heathkit. The keyer is mounted on a vector board and located in the rear side corner of the HW-7. The keyer is connected directly across the supply terminal since no regulation is necessary. The speed adjustment pot and auto-space switch are both mounted on the rear plate. A tune pushbutton is also included to facilitate the tune-up of the rig. Since a twin paddle is now needed instead of a straight key, a 3 conductor earphone jack is installed where the previous jack was located.

Rear view of the control layout on the HW-7.



Inside view of the "Siamese" twin paddle key. Two inexpensive straight keys are used, although higher quality keys could be substituted. Box measures 4" x 2" 3/8" x 6" inches.

The twin paddle built makes use of two straight keys in a Siamese paddle configuration.[2] Two inexpensive straight keys were bolted together and mounted perpendicular to the bottom of a small utility box. Two small paddles, made from a fiberglass PC board, were then connected to the two straight keys. If a better "feel" is needed, two higher grades of straight keys can be used. However, the original design is quite adequate.

The QRP Accu-Keyer is definitely the answer to the power crisis when working QRP from a battery source. Extremely low standby power can be obtained by using the CMOS integrated circuits. This keyer can be used with any rig if the appropriate driver transistor is installed. I hope these suggestions will be helpful to those who work CW-QRP from a finite power source.

Additional Reference

COS/MOS Digital Integrated Circuits SSD-203A, RCA.

. . . WA5KPG

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[2] Hexter, "The Siamese Paddle", *Hints and Kinks*, Volume Six, p. 66.

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Catenary Suspense

Take my advice: Don't use a hockey stick on your cat! Strange things are liable to happen. Aunt Henna was quite well adjusted for a cat until I began to use the stick. You see, she disagreed with me about the need for her to go out at night – and with glaring yellow eyes hid as far back as she could under any handy bed. Hooked with the hockey stick, however, there'd be a loud yowl, a scramble of flailing claws – as I chased her to the open door, where she would leap into the snow, yelling her outraged head off.

For a short period the system seemed to be working quite well. I even tried to believe the message was getting across. Soon, I thought, she would go to the door by herself and meow plaintively, like a well-trained puppy.

Aunt Henna had other ideas. For one thing, I noticed she suddenly had taken an avid interest in television. For hours she would stare at the boob tube, her eyes wide and unblinking. At the same time, while watching, she was soon making strange sounds in her throat. Preference of programs? She looked at 'em all – and even, we were astounded to note, learned how to turn the set on and off, but mostly on.

And so things continued most of last winter, hockey stick routine included. She definitely didn't want to go out – and adroitly evaded me a good part of the time, dashing back to her beloved TV.

One evening in May my hockey stick must have clipped her a bit, instead of scooping.

"You bastards," she spat.

"Look here, Aunt Henna," I said, "no use including the family. This is all my idea. Make that single."

"Hurry down to Railroad Salvage and save, save, save, brother," she hissed.

Then it dawned on me that Aunt Henna had cussed me out. Perhaps I was cracking up. My XYL, Amie, was standing in the doorway, a twisty smile on her map. "I heard you talking to someone in here. What's going on?" she demanded.

"Aunt Henna called me a bastards. I was merely trying to correct her grammar."

Amie turned on her heel. "I'm going to lock up the liquor. You ought to be ashamed."

Just then Aunt Henna stalked out from under the bed, tail high, padded feet taking her gracefully toward the babbling TV. "Sucker," she muttered.

"I tell you," I yelled to Amie, "This damn cat talked to me. Go on, kitty, say something else!" All I got was a feline smile – or something in that cat-e-gory.

The booze was promptly locked up.

Later in the evening I sensed that Amie was sort of looking at me sideways. "Don't you think it would be wise to see Dr. Bingleflick? You haven't had a checkup in a long time. Besides, Katy Bingleflick tells me he just got his Extra Class ham ticket. Your Advanced deal somehow is not a word I would normally associate with you."

"Yes, dear." The rest of my reply, silently recorded, was to get me a private supply of vodka, which could be stashed away in the garage. I was going to need it for sure.

In ensuing weeks Aunt Henna gradually became more friendly, even sitting contentedly by me when I was on the air. She never would speak in Amie's presence – but on other occasions was pleased to tell some of the boys she was a six year old cat and got a bang out of ham radio. "No kitten," she was wont to add. That generally put them in the aisles – but obviously they suspected me of some sort of hoax.

Out of deference to her growing erudition, it seemed only fair to lay off the hockey stick business. She was soon busily learning to read, almost ignoring the TV. Evidencing a great interest in electronics, she was becoming expert on the subject, particularly anything to do with antennae.

Then came an unexpected catastrophe. She lapsed back into form and ate our canary. It was a lovely spring afternoon. I was getting ready to string a new 40-meter dipole over the back lawn. The gilded cage had a neat little hasp on its door – but somehow she got it open. Only a few yellow feathers lay under the cage by the patio rubber plant. She'd practically inhaled the bird. It was that fast.

I shook an admonishing finger at her, a bit at a loss for words. She was daintily wiping her whiskers with a paw, studying a Sears Roebuck catalogue. Anything that had to do with the word cat stirred her interest. Her great, fluffy tail waved gently. "Mister," she said, "would you like me to help you get that dipole up?" This was an abrupt change of subject, a feint to divert the lecture she knew I was about to deliver.

For years it's been a ritual to don my "Robin Hood"-Bavarian climber's hat, complete with feathers, when preparing to string up a new antenna between trees. My trusty bow and arrow can almost always arch the arrow over the highest sturdy fork of branches available, bringing with it a thread, then line and pulley. Without the hat and a good shot of vodka I'm liable to shoot myself in the foot.

"You look foolish in that gear," said Aunt Henna. "You want me to help you get that wire up in the air?" Her voice trailed off, then returned suddenly, "Hurry down to Railroad Salvage and save, save, save, brother! 430 people were drowned when the ferryboat turned turtle. A raging fire has now become a holocaust in the stricken city . . . "

"Hold it, Aunt Henna," I cried. Her boob tube categories were merging in general confusion. "Just how do you propose to assist?" I asked, trying to get her back in the groove. "Perhaps this is a bit over your head."

"Since my mean altitude is only about ten inches, it better be, Mister, if you expect to get out anyplace."

"Not anyplace – anywhere," I admonished. "Your English is simply dreadful."

Well, in short order Aunt Henna had started up the 80-foot pussy willow tree, the thread, with a small weight attached to its end, in her mouth. Up, up she went, occasionally jumping to an adjoining trunk of the huge tree. At about 65 feet I shouted for her to drop the weight over a crotch. Down it came beautifully.

With the mission accomplished, she then stretched out on a branch, her great tail flicking this way and that, which it always did when she was thinking deep thoughts. "You know, Mister," her voice drifted down, "it was a mistake eating that bird."

"Yes, I know. It was very naughty."

"Oh, I don't mean that. It's given me a wicked stomach ache. It's been a lousy day, with awful TV programs. That yellow bird – canary you call it? – was the catalyst that's brought on one of my dizzy spells."

This was alarming. "Just hold on tight," I called, "until it passes. You'll be all right. Take a cat nap or something."

"My middle, with that miserable canary in it, is supported between my front and hind legs in catenary suspension." Her voice was growing weaker. "You get it, Mister?"

In the instant I was mulling that one over, there came a screech from on high – and down came Aunt Henna tumbling through the spring foliage. She hit with an enormous thump and lay still. I rushed over and bent down.

She opened one eye and murmured, "This is the end, a cataclysm!"

"Oh, no, Aunt Henna. I'll get you down to Dr. Bingleflick – he'll fix you up."

"He's for humans – not a cat doctor."

"Veterinarian, please," I corrected. "But since you are almost human . . ."

"Thanks a lot," she said, now back on three of her feet, tail twitching violently – and a ground dragging droop in her middle.

We stopped off in the garage so I could brace myself slightly. Two or three good slugs of vodka seemed in order. Noting her gleaming eyes, both of them now back on duty, I held out the bottle. "Like some?" I asked.

"Just a touch," she replied. "I found where your Amie hid the key to your main grog supply."

"And that was?"

"In the ashes of her cremated Uncle Jake's urn, which she keeps on the top shelf with her hats in your closet."

From her rambling comments, it developed that Aunt Henna had been nipping on the main supply for some time. The afternoon's exploits, including demolition of the canary and plunge from the willow tree, related to an over abundance of cat nips. She was now wabbling and weaving

around some paint cans. "Are we going to Dr. Flickbingle's?" she asked. Her eyes were slightly crossed, or perhaps I was looking in my workbench mirror at the moment.

It suddenly occurred to me that Amie had the car. Here we were in the garage and it definitely was not around. "If you don't mind," I apologized, "we'll take Amie's bicycle – OK?"

Aunt Henna jumped into the basket. "You better open the door as a precaution for a dignified exit. Your Amie won't like it if you bang up her bike."

It was easy to ignore such flippant remarks, considering their source. I couldn't help admiring the old cat, as she stood proudly in the front basket, her feet slipping through this way and that as she lurched around for a footing.

"Let us be off," she ordered.

Dr. Bingleflick's office was on the other side of the town, close to the airport, which we would pass on our way. For some odd reason, the road had become very unsteady, like a rippling, waving ribbon, hardly suitable for bicycling.

Anyhow, as we came abreast of the airport, Aunt Henna let out another great screech, pointing with her bad foot at a huge four-engined jet that was parked close by.

Slamming on the brake, I nearly went over the handlebars. "What in the world is the trouble?"

"That's the fantastic plane they were telling us about on TV! It can take off straight up."

"So-o what?"

"So – this I've got to see closer. Please, can we go in?"

Aunt Henna had a most persuasive way about her. After all, why not humor her? It was a lovely spring afternoon. We were in no hurry, at least I wasn't.

Jumping from her basket, she was up on top of the Cyclone fence in a flash, her tail swishing around like a kid's pinwheel. "Hey, look at that guy," she yelled. "What's he doing? I smell birds!"

A sort of grid-platform stepladder was in place at the front of the outboard jet engine on our side. A mechanic with a big mesh screen in his hands was descending the ladder. In the screen were what seemed to be a mess of ducks, starlings, geese, or what have you – mostly mushy looking stuff.

"Looks like those birds weren't so smart tangling with that big job," I offered.

"Yeah," said Aunt Henna. "This I must see." With that she jumped down and in a graceful arc of motion was up on the platform stepladder.

By this time, the mechanic was trundling his screen full of crunched birds toward the hangar. He paused for an instant, looking up at an engineer gazing from the pilot's window. "OK – Jack, blow her and you'll clear the rest of the trash."

Here's to a cat
Named Aunt Henna
Who ate a fat bird
For her denner
In a similar vein
She was et by a plane
Which one was
The wickeder sinner?

An accelerating whirl of enormous noise screamed into being as the engine started up. Aunt Henna was on top of the ladder, clutching with all three feet and part of the other one. For a second or two she managed to hang on – but there was nothing to get her claws in. Then she departed into the engine with tremendous velocity, a blurred flash of fur. She had simply vanished in the gigantic suction.

The speed of it all was shocking. It took me some moments to get hold of things. Then, pedalling slowly homeward, it all seemed rather just retribution. Cat eats bird – airplane eats cat...

Certainly there was no need to tell Dr. Bingleflick any of this. There was no proof. Nothing. He would surely have good reason to have me put under observation. As for Amie, she wouldn't believe anything anyhow. There was only one answer! Tell Wayne Green... He wouldn't dare print it in 73... The boys would be sure *he* was nuts... 'By, now.

...W1BNN

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Copper Rip-Off

After a recent move, as often happens, an urgent construction project came up before some of my tons of boxed junk had been unpacked. A PC board was needed. My plastic bottle of ferric chloride was nowhere to be found.

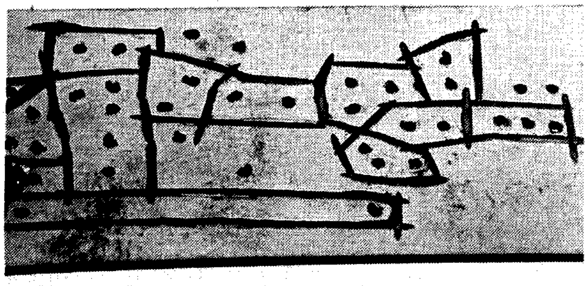
I needed to whomp up a mixer board and did not want to use a perforated breadboard. As is true with most mixers, I needed all the shielding I could get. About ten years ago I saw a board for an emitter follower that someone at the Navy Research Lab had made by cutting the foil rather than etching it. My rat's nest memory said, "Try it."

An ideal method is to use a hand-held high speed rotary drill with a burr bit. Not having one, I used an ole faithful ¼" drill, with a small rotary saw blade. The results, as pictured, are in the "worst possible case" category, but the technique worked. The mixer was built and was successful.

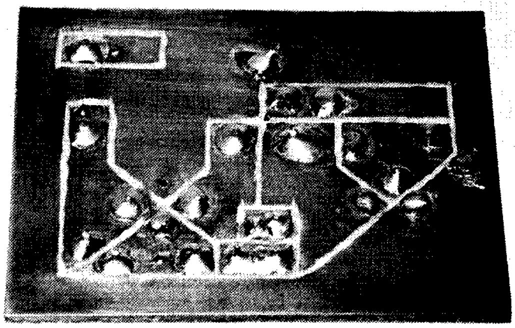
Also pictured is a more civilized, carefully made, professional looking example of mechanical removal of copper clad.

The point is, however, that you can prepare a PC board mechanically, whether by sawing, reaming, burring or using an Exacto knife, rather than by chemical etching, if it becomes necessary to do so.

. . . W7SHY/6



The "worst possible case" category, done with a rotary saw blade.



A more professional looking example of mechanical removal.

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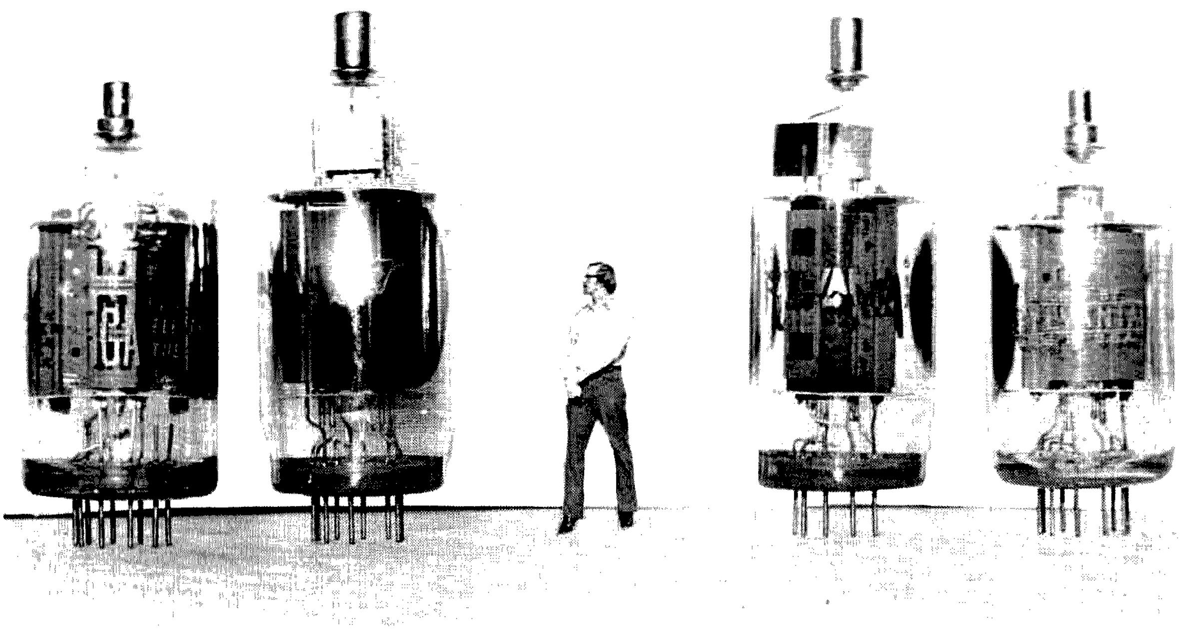
Eastwood Vil. #604 N.
Birmingham AL 35210

Better Results from those Sweep Tubes



Sweep tubes have come of age, and are appearing in more and more ham transmitting gear. The first group of sweep tubes to appear in transceivers, 6GE5s, 6GJ5s, 6JB6's, etc., were of the 200-300 W class. Soon their "big brothers," like the 6JE6s, 6LQ6s, etc., became more prevalent, running a solid half gallon. Now, these tubes are finding their way into many linears, both commercial and home brewed. Sweep tubes are very popular because they are quite efficient and relatively inexpensive.

Listed herein are some tips which I have found that will help assure longer life and improved efficiency from these "little bottles."

A fan is the most worthwhile investment you can make, since most rigs restrict the air flow around the final amplifier to a marked degree. Heat is the main killer of not just sweep tubes, but all tubes. A small fan blowing across the final is better than no fan, and it can be mounted to the side of the final or even placed on the desk beside the rig. However, a fan above the final pulling the air up is preferred.

It's best to mount the fan directly over the final amplifier compartment. Vibration can be reduced by the use of felt pads under the mounting bracket(s). I have found this to extend tube life and efficiency to a marked degree. Needless to say, this is practically a necessity with the 500 W transceivers, or high power linears.

A choice fan for this application is the fan manufactured by Rotron and Delwin, like the whisper, muffin and skeleton fan; they are quiet and they move plenty of air.

Photo by Don Langston WB4JVY.

When adding the fan, try one on the power supply also. Most transceiver supplies run pretty hot, especially the 500 W units. A fan will at least keep the transformers and diodes cool enough so you can touch them without second degree burns.

If you use a sweep tube linear, either commercial or home brew, try to use as low idling current (high bias) as practical – this extends life appreciably. One easy way to do this is to increase the bias until the output just starts to drop off using an swr bridge or watt meter for indication (I assume the rig is already tuned and drive is applied as usual for full CW carrier). This bias setting is usually close to optimum and linearity is usually excellent.

Another method, when an output indicator is not on hand, is to increase the bias (from a very low value) while the tubes are idling with no drive until the plates cool from cherry red to a no-color condition. Usually the plates will show color (blood red) after a no-drive idling state for about 30 seconds when the idling current is too high (bias too low).

On CW use minimum drive; in fact, it's best to cut power (by inserting less carrier, not by loading rig lighter) to about one-half the sideband rating unless your keying is around 15-20 wpm and then only two-thirds the sideband rating would be the most practical value.

The swr is especially critical on CW and an swr of even 1.5:1 may cause these tubes to blush even more under key-down condition. It is also a good idea to note the exact dial settings of the loading and plate tuning on all bands to prevent an off resonance condition when tuning up. With a simple chart of all settings the plate need never come off resonance by more than 30 milliamperes. Tune-up time can be reduced further by the use of a scope or modulation indicator. A meter takes time to "settle," whereas a scope is accurate immediately.

So, there you have it. Try some of the ideas presented above and see if you're not happier with your sweep tube rig. I'm sure you will be pleasantly surprised.

... K4TWJ

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The Best Logic Yet

When I first got into amateur radio just about three years ago, I had a little understanding of the way tubes worked. I decided that if I built anything for the shack it would be with tubes – and that I would just buy anything that had to use that mysterious solid state.

This decision did not last for long, however. I just don't like having to buy everything, since I'm really a builder at heart. So all that was left for me to do was start learning about solid state. I started building some projects from the pages of "73" and some other magazines – some worked and some didn't. When they didn't, I was usually lost as to why.

Then I found that the projects that used what was called TTL logic usually worked the first time and that when they didn't I could usually find out why. Over a period of a few months I had formulated a list of fundamentals that almost assured that the projects would work.

Presented here are some of those fundamentals from my notes. If you use them as a guide line I know you can do as well or probably better at TTL projects than I have.

FIRST: The power supply for TTL is one critical spot. The absolute maximum voltage for most of the TTL ICs is 7 volts, with 5 volts being normal. *Stay within 4.5 and 5.5 volts.*

SECOND: Find the output pins, and *do not connect two outputs together.*

THIRD: If you use the 5 volts from the power supply for an input signal on an input pin or for any reason put the 5 volts from the power supply to an output pin without a load, *connect a resistor in series* (any size from 100 Ohms to 10k Ohms will work in most cases).

If you follow these first three design rules you will find that it is almost impossible to damage the ICs and you can now experiment with them all that you want to.

Now that we are not going to send the IC up in smoke, let's see what we will find inside some of them and how we can put them to work for us.

The first one to look at, which is the simplest of all, is the buffer. With the buffer the output is the same as the input. It is used to isolate the input circuit from the output and also to drive more circuits than your input signal may be able to. The logic symbol for a buffer is shown in Fig. 1.

With the buffer, if we put "0" volts or ground on the input, the output will be "0" volts. If we put 5 volts (often referred to as logic 1) on the input, the output will be 5 volts (logic 1). See Fig. 2.

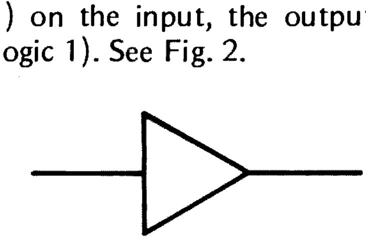


Fig. 1.

You will notice that the input is a square type wave; this is the type of input that digital circuits need to work properly. There are input circuits that will let us use sine wave inputs and some special ICs which are designed for a sine wave input, but for now we will stay with the square type input.

One digital IC which uses the buffer is the 7407 hex buffers/drivers. This chip has six buffers on the one IC. Each buffer can be used separately. (The layout of the chip is shown in Fig. 3.)

Note that +5 volts goes to pin 14 and that ground is on pin 7. This supplies power for operation of all six buffers. With an input on pin 1 you get an output on pin 2, while an input on pin 3 will give you an output on pin 4, input on 5 for output on 6, input 9 for output on 8, etc.

One thing that works out nice for testing

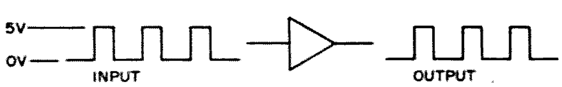


Fig. 2.

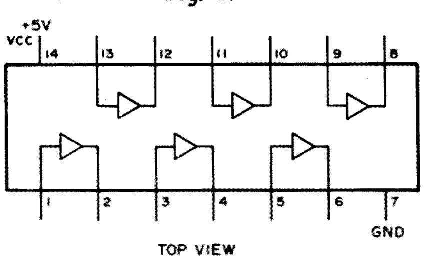


Fig. 3.

is that if an input is not connected to anything (is floating), the IC sees it as logic 1 (5 volts) and the output goes to 5 volts. If the input is grounded (logic 0) the output goes to 0 volts. You can test a chip by watching the output on a voltmeter as you ground and unground an input.

FOURTH: *Consider a "Floating" input as logic 1.*

If an input is to be at 0 volts make sure that it is connected to ground.

The next "gate" to look at and experiment with a little is the inverter. It is almost the same as the buffer, with one exception: its output is always opposite from the input. The logic symbol for an inverter is shown in Fig. 4. (The only difference between the symbol of an inverter and the symbol for a buffer is the small circle at the output.)

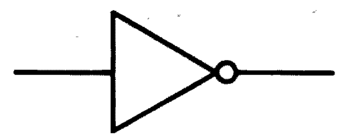


Fig. 4.

With the inverter, 0 volts or ground on the input will give you 5 volts (logic 1) on the output, and 5 volts on the input (or a floating input) will give you 0 volts on the output. See Fig. 5.

One digital IC which uses the inverter is the 7404 hex inverter. This chip has six inverters on the one IC. Each inverter can be used separately. The layout of the chip is shown in Fig. 6.

Note that on the 7404, +5 volts is on pin 14 and that ground goes to pin 7. This supplies the power for operation of all inverters. With an input on pin 1 you get your output on pin 2, while an input on pin 3 will give you an output on pin 4, etc.

It is possible to use an inverter as a buffer by putting two gates in series. As an example using the 7404, you could connect pins 2 and 3 together, place your input on pin 1 and take the output from pin 4. The output now will be the same as the input just like with the buffer. See Fig. 7.

One other thing that you may want to keep in mind about the inverter is its other name: the "NOT" gate. This comes from the fact that its output is NOT the same as its input. But whether you call it an inverter or you call it a "NOT" gate, it is the same thing with the same symbol.

Another gate that you will find in the logic family is the "AND" gate. It is similar to the buffer, the only difference being that it has more than one input. The logic symbol for an "AND" gate is shown in Fig. 8.

With the "AND" gate, both inputs must be at logic 1 (5 volts) before the output will be logic 1. This is where the gate gets its name: input 1 AND input 2 must both be 1 (5 volts) to get a 1 for an output. See Fig. 9.

The "AND" gate can also be used as a buffer and there are two ways to do it. One

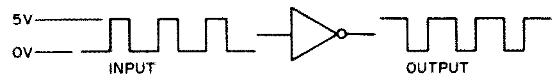


Fig. 5.

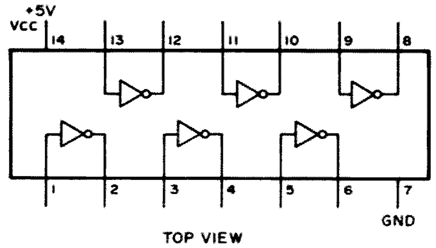


Fig. 6.

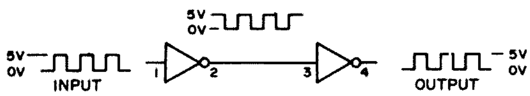


Fig. 7.

way is to put a constant 5 volts on one of the inputs and put your input signal on the other. (If you use this method use a resistor in series with the 5 volt power supply.) The other way is to connect the two inputs together and put your input signal into both at the same time. See Fig. 10.

One digital IC which uses the "AND" gate is the 7408 quad 2-input AND gate. This chip has 4 "AND" gates on one IC. Each gate can be used separately; the layout of the chip is shown in Fig. 11.

As with the other chips, the +5 volts is put on pin 14 and the ground is put to pin 7. Input 1 and input 2 go to output 3. Input 4 and input 5 go to output 6, etc.

In some circuits it is desirable to have the two inputs with the AND function, plus the signal inversion of the NOT gate (inverter). This is now easy to do by using the two gates together. See Fig. 12.

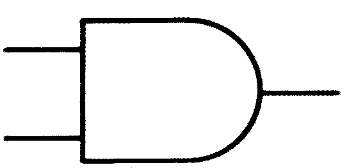


Fig. 8.

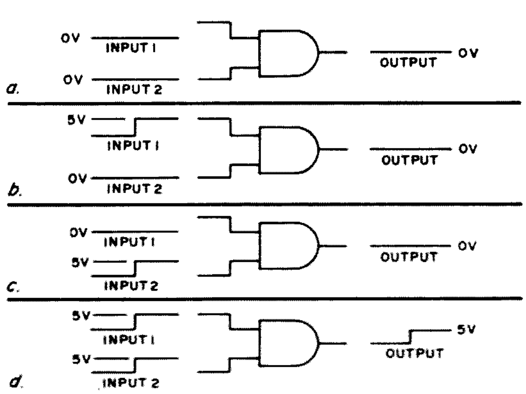


Fig. 9.

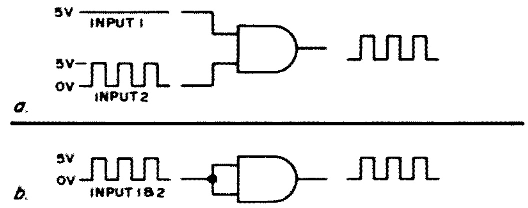


Fig. 10.

The use of the "NOT" and the "AND" gate together is a very common combination, so common in fact that it is considered as another gate called a "NOT-AND" gate or even more frequently a "NAND" gate. So remember, when you see "NAND", that it is just an "AND" gate followed by a "NOT" gate. These two gates are often combined on one chip as one gate and the symbol for the combination, the "NAND" gate, is shown in Fig. 13.

You will notice that the only difference in the symbol of the "NAND" and the symbol of the "AND is the "o" at the output of the gate. In the use of logic symbols the "o" will indicate that the signal is inverted.

One digital IC which uses the "NAND" gate is the 7400 quad 2-input NAND gate. This chip has 4 "NAND" gates on the one IC. Each gate can be used separately; the layout of the chip is shown in Fig. 14.

As can be seen, +5 volts goes to pin 14 and ground goes to pin 7. Inputs 1 & 2 go to output 3, inputs 4 & 5 go to output 6, etc. The 7400 is one of the most widely used ICs of the TTL logic family, since it can be used as a buffer, as an inverter or "NOT" gate, as an "AND" gate, and as a "NAND" gate. Whatever the operation you have in mind, the 7400 can be made to work. Not bad for

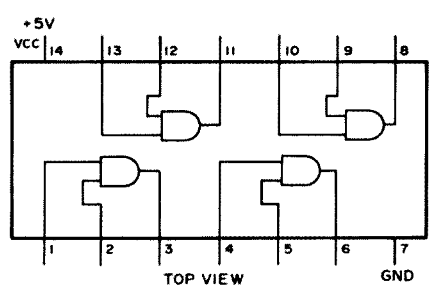


Fig. 11.

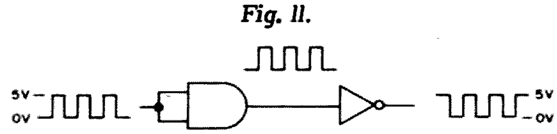


Fig. 12.

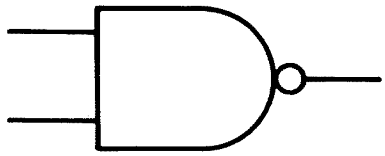


Fig. 13.

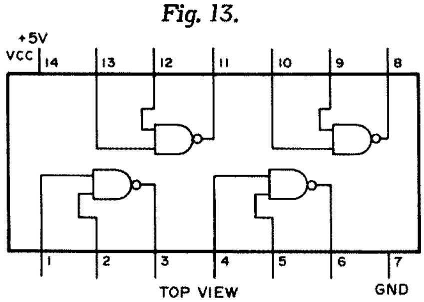
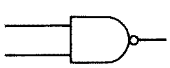


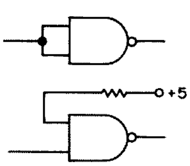
Fig. 14.

an IC that can be picked up for under a dollar. Fig. 15 shows how to connect it to work as the different gates.

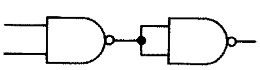
Another type of gate that you may come across is what is known as an "OR" gate. It is similar to the "AND" gate with one exception: With the "AND" gate you had to have 5 volts (logic 1) on both inputs 1 *and* 2 to get logic 1 (5 volts) for an output. With the "OR" gate, a 5 volt input on input 1 *or*



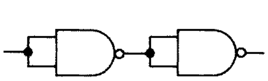
"NAND" — Use each gate as is.



"Inverter" or "NOT" — Connect the two inputs together, or connect one input to +5 volts and use the other input for your signal.



"AND" — Feed the output of one "NAND" gate into a second gate that is connected as a "NOT" gate, and take your output from the second gate.



"Buffer" — Feed the output of one gate connected as a "NOT" into a second gate connected as a "NOT", and take your output from the second gate.

Fig. 15.

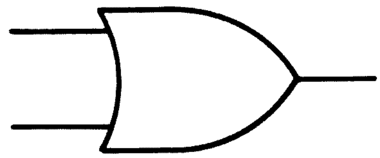


Fig. 16.

2 will give you logic 1 output. The logic symbol for an "OR" gate is shown in Fig. 16, and its operation is outlined in Fig. 17.

One digital IC which uses the "OR" gate is the 7432 quad 2-input OR gate. This chip has 4 "OR" gates on one IC. Each gate can be used separately; the layout of the chip is shown in Fig. 18.

As with the other ICs that we have looked at, the +5 is to pin 14 and ground is to pin 7. Inputs 1 and 2 go to output 3, inputs 4 and 5 go to output 6, etc.

In some circuits it is desirable to have the two inputs with the OR function, plus the signal inversion of the NOT gate (inverter). It is easy to use the two gates together as shown in Fig. 19.

The use of the NOT and the OR gate together is also a very common combination. The combination is usually considered as one gate called a NOT-OR gate or, more commonly, a "NOR" gate. The logic symbol of a "NOR" gate is shown in Fig. 20.

Note that the only difference in the symbol of a "NOR" gate and the symbol of an "OR" gate is that the "NOR" gate has a "o" at the output.

FIFTH: *Consider a "o" at any chip to show the signal is inverted at that point.*

One digital IC which uses the "NOR" gate is the 7402 quad 2-input NOR gate. This chip has 4 NOR gates on a single IC. Each gate can be used separately; the symbol for the chip is shown in Fig. 21. The +5 goes

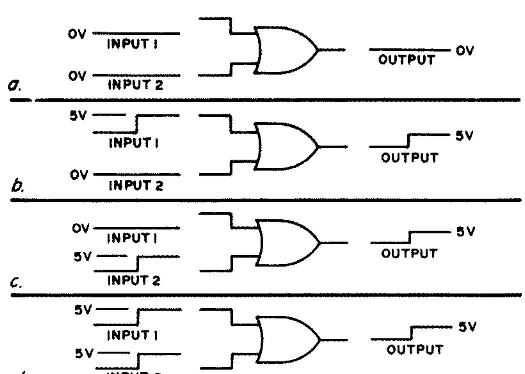


Fig. 17.

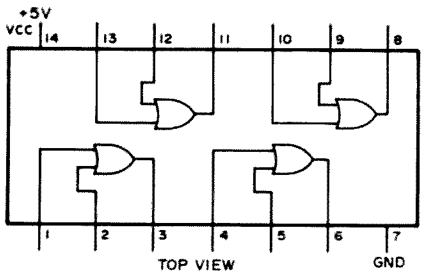


Fig. 18.

to pin 14, ground to pin 7, inputs 2 and 3 to output 1, inputs 5 and 6 to output 4, etc.

With this chip you can have the operation of a "NOR" gate, the operation of a "NOT" gate (inverter), the operation of an "OR" gate, and the operation of a "buffer". Fig. 22 shows the connections for the different gates.

Two other IC gates that you may run across are:

1) The 4-input "NAND". There is not much difference between a 4-input gate and the 2-input gate that we looked at before. With the 4-input "NAND" gate, all 4 inputs must be at 5 volts (logic 1) to get 0 volts at the output. If any input is ground (logic 0), the output will stay at 5 volts. See Fig. 23 for the logic symbol of the 4 input "NAND".

2) The 8-input "NAND". With this gate we find that all 8 inputs must be at logic 1 for the output to be at logic 0 (ground). If any of the inputs is at ground, the output will stay at logic 1 (5 volts). See Fig. 24 for the logic symbol of the 8-input "NAND".

I have not tried to show all of the ways that TTL logic can be used or all of the different types of gates that you may see from time to time. I have not included anything on flip flops, decade counters, or any of the more complex ICs, most of which would take an article the size of this one to discuss fully.

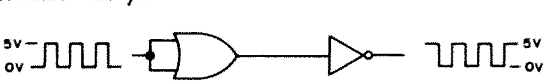


Fig. 19.

Fig. 20.

What I have tried to do is show some of the fundamental logic gates that make up most of the TTL logic circuits. If you have an understanding of the operation of the "buffer", the "inverter" (NOT) gate, the "AND" gate, the "NOT-AND" (NAND) gate, the "OR" gate and the "NOT-OR" (NOR) gate, you are ready to start building with TTL.

My suggestion now is to get a 5 volt power supply, and 2 or 3 7400s, and see just what they will do. Then pick a project from the pages of "73" Magazine, and try it. Don't be too surprised if it works the first

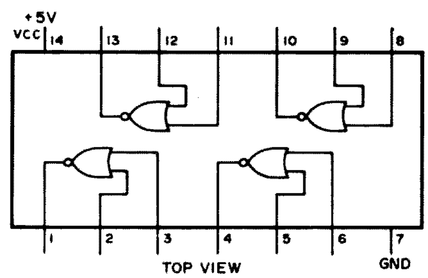
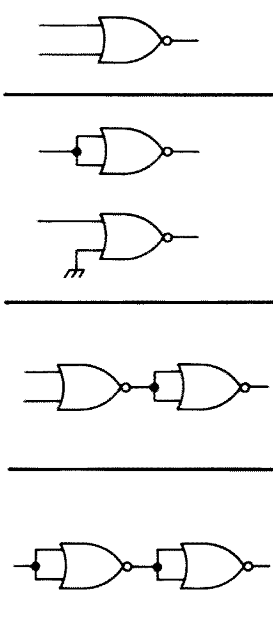


Fig. 21.



"NOR" — Use each gate as is.

"NOT" — Connect the two inputs together, or you can put one input to ground and use the other input.

"OR" — Feed the output of one gate into a second gate that is connected as a "NOT" gate.

"Buffer" — Feed the output of one gate connected as a "NOT" into a second gate connected as a "NOT".

Fig. 22.

time the power is turned on. If it doesn't, look back over the fundamental gate operation and I'll bet you find out why in a very few minutes.

Above all, remember "Browning's Rules of Order":

I. Stay within 4.5 and 5.5 volts.

How to

COMPACT MULTIBAND DIPOLES

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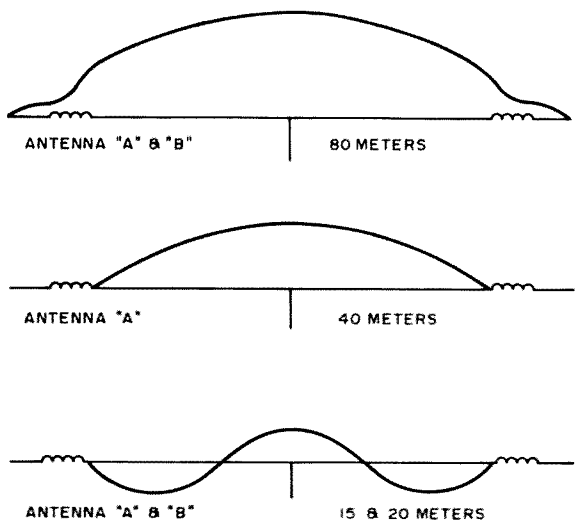
Often the need arises for a temporary or permanent low cost antenna. Usually, a dipole or inverted vee antenna is the logical choice. They are easy to install and certainly cheap to build. One of the disadvantages of such an antenna is that they are only usable on a single band, unless they are fed with an open feeder line (300–600Ω) in combination with an antenna tuner. This article describes two types of dipoles for operation on A) 80, 40 and 15 meters; and B) for 80 and 20 meters.

These dipoles are fed with a random length of 50Ω coax, and they can be strung as straight dipoles or inverted vees. The latter configuration makes it easier to adjust the antenna for resonance and requires only one high support. Each antenna leg has one loading coil to obtain the desired resonance points on the described amateur bands.

Theory

Generally, centerfed dipoles can be fed with 50–75Ω coax if the current maximum of an operating frequency occurs at the antenna feedpoint. Therefore, a dipole with the leg dimensions of 67, 35, 18 or 11.5 feet will show a feedpoint impedance of 50–75Ω for 80, 40, 20 or 15 meters accordingly. If a portion of each 67 foot leg (80 meter halfwave dipole) is substituted with a loading coil, and that loading coil is placed at the correct position, the dipole can be made to have current maxima at the feedpoint at 40 and 15, or at 20 meters.

For example: If a loading coil is placed about 35 feet from the feedpoint, a current maximum will occur at the feedpoint for 40 meters. With the correct coil dimensions and top-wire length, the dipole can also show current maximum at the feedpoint for 80 meters. In both cases, the dipole functions electrically as a halfwave dipole.



Graph 1. Antenna current distribution.

Coincidentally, since the 35 foot wire portion from the feedpoint to the loading coil corresponds to 3 x 1/4 wavelength on 15 meters, there will also be a current maximum at the feedpoint for 15 meters. Thus, the antenna will work on 80, 40 and 15 meters when fed with a 50–75Ω coax.

The 50Ω coax (RG8U, RG58U) is favored as the loading coils decrease the feedpoint impedance from a theoretical 75Ω (classical halfwave dipole) to about 50Ω.

If the leg- and coil-dimensions are altered, the antenna can be made to work on 80 and 20 meters. Here, the antenna functions as a halfwave dipole on 80 and as a 1½ wave dipole on 20 meters.

Ten meter operation is possible with both antennas, but the swr is in the order of 3:1 or worse.

Antenna Dimensions

Dipole A – 80, 40 and 15 meters
Overall length: 2 x 41.5 feet
Leg dimensions: 61 feet of wire, coil, 5 feet of wire

Dipole B – 80 and 20 meters
Overall length: 2 x 61 feet
Leg dimensions: 53 feet of wire, coil, 5 feet of wire
See Graph 1.

Antenna Assembly and Coil Data

Prepare the loading coils for the desired dipole, model A or B. For coils (antenna A) densely wind 70 turns of #20 copper enamelled wire on to a 1¼ inch O.D. plastic body. Use 24 turns for coil antenna B. Plastic sewer pipe is suitable and readily available everywhere. You need about 2 x 5 inches for A and 2 x 3.5 inches for B for convenient assembly. The coil windings are secured and weatherproofed with varnish or better with epoxy glue. The wire ends are soldered on to bolted solder lugs, which also serve to connect the antenna wire to the coils. (See Fig. 1.)

The antenna wire should be #14 or #16 copperweld for adequate strength. The dipole center is a porcelain strain insulator; it secures the wires at the dipole center and permits you to solder an SO-239 coax receptacle to the wires for easy coax connection. The far ends of the dipole are terminated on porcelain eggs. I recommend nylon or other nonmetallic line for fastening the porcelain eggs to a support. If wire is used, corona flashovers occur across the eggs at higher power levels.

Calculating Wire Length

Both dipoles should be cut specifically for your primary operating frequencies. Precise wire length can be calculated from the formulas given below, provided you stick with the recommended coil dimensions. Note that the wire lengths for 80 meters (A and B) include the wire portion from the center to the coil plus the coil to the porcelain insulator at the antenna ends.

Antenna A

80 meters: Ft. per leg = 153000/kHz
40 meters: Ft. per leg = 250000/kHz
15 meters: Ft. per leg = 750000/kHz

Obviously, if you optimize your 40 meter resonance for 7200 kHz you cannot reach optimum conditions on e.g., 21.100 kHz, since the 15 meter resonance occurs automatically on 3 times the frequency than that of 40 meters. You therefore have to compromise slightly. 7,100 kHz seems like a good compromise, keeping in mind that the swr on 15 meters is fairly low over the entire band.

Antenna B

80 meters: Ft. per leg = 227000/kHz
20 meters: Ft. per leg = 750000/kHz

Tuning Procedure

First the antenna is adjusted for resonance (minimum swr) on the high frequency bands, 40 and 15 or 20 meters. This is done by lengthening or shortening the wire portion from the feedpoint to the loading coils. To increase the resonance frequency shorten this wire portion, and to decrease the resonance frequency lengthen the wire portion in each antenna leg symmetrically. A change in wire dimension will affect the resonance frequency for the 80 meter band. Therefore, the 80 meter tuning is done next by shortening or lengthening the 5 foot wire portion between loading coils and porcelain eggs. This last adjustment is critical; about one inch of wire results in 20 kHz resonance change on the 80 meter band. The second tuning step will not affect the first one. Do not forget to adjust both antenna legs symmetrically.

Comments

I tried both antenna versions as inverted vees, mainly because it simplified the tuning procedure very much. The swr at resonance for antenna A was 1.1:1 at resonance on 80, 40 and 15 meters.

Antenna B showed an swr of 1.5:1 on 80 and 1.1:1 on 20 meters at the resonance frequencies. I assume that the poorer 80 meters swr results from a relatively low Q and L of the loading coil of antenna B. The signal reports on 80 and 40 meters were excellent, and 20 and 15 meters showed a difference of about 3 S-units in receive mode as compared to my 2 element quad antenna. The antenna can also be tuned with a grid-dip meter.

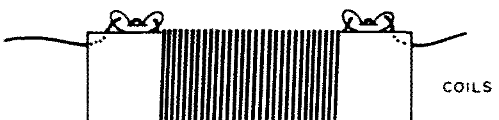


Fig. 1. Coil layout.

. . . VE3GSP

Michigan Radio Doctor
Michigan Mother Trucker

Don't Feed the Bears!

It seems that as the weeks go by, you read more and more about CB antics in the papers. As more drivers rebel against the government imposed 55 mph speed limit, the citizens radio service, better known as CB, is being used to avoid wallet thinning (and insurance cancelling) tickets. Approximately 40% of all the big trucks on the road have CB radios in them to watch for "Smokey." If you tune in channel 10 (27.075 MHz) and live near a major highway, you will probably hear the strange lingo. Some of it is easily recognized, and some of it is not. Even though CB has a rather short useful range, due to frequency congestion and the illegal use of high power amplifiers, it is still useful for about 10 miles mobile to mobile, 15 miles mobile to base, and 25 miles base to base. This is more than enough to watch for "Smokey" or to report accidents or other highway emergencies. Many state and local police monitor channel 10 and/or channel 9 for just that reason. On many expressways between metropolitan areas, it can be 15 miles or more to the nearest phone or exit where help can be called.

Unfortunately, there have been some areas of abuse by both the users and the law. Many police resent the truckers' use of CB to avoid tickets and speed traps, and in turn, use it to find out if they are known to the speeders. In some areas the police will issue a ticket for only one or two mph over the limit if they hear the offender on CB warning other truckers of where the "Bears" are. It has also been known that they will write a ticket on an out-of-state vehicle for 70 in a 55 zone, even if they don't actually see the driver going 70. If they heard the driver say, "We got the hammer down to that 70", they apparently figure that you're from out of state and won't stay to fight the ticket. And after all, they heard you publicly admit to doing more than the limit.

On the brighter side of the road, there are many great "Smokies" out there and many of them spend a lot of time talking to the truckers and telling them where the traffic tie-ups are and how to avoid them. I have even had the Illinois and Indiana Smokies tell me to "put the hammer down, the way is clear for 40 miles," and mean it.

Oh, well! Let's face it! No one wants a ticket or $25 fine, no matter why or how much he exceeds the limit, so here is a collection of words and phrases frequently used to describe what is happening on our highways. You too can decipher channel 10, but be careful: Don't feed the bears!

Advertising	*Police car with lights on.*
Back Door	*Friend following behind you guarding the rear approach (the friend can be the truck you just passed two minutes ago).*
Bear	*Any Police Officer.*
Bear Cave	*Police station or Highway Patrol post.*
Beat the Bushes	*Lead mobile driving just fast enough to cause a police car to come out of hiding to investigate, but not fast enough to get a ticket; a sacrificial lamb, looking real hard for Smokey.*
Beaver	*As in, "Feed the Beaver" — give your money to Mama, not to Smokey.*
Break One-Oh	*Break on Channel 10. (I want to talk.)*
Break Ten	*Break on Channel 10.*
Bushels	*As: "I got 70 bushels" — 1 bushel = 1000 lbs.*
Camera	*Radar unit used to check speed of vehicles.*
Channel 10	*CB channel 10 — 27.075 MHz, truckers' paradise.*
Chicken coop	*Truck weighing station.*
Clean	*No police seen.*
Comic Books	*Truckers' logs.*
Cotton Picker	*Usually used in place of swear words, such as, "That cotton pickin' Smokey gave me a cotton pickin' ticket."*
County Mounty	*County Police or Sheriff.*
Ears	*Radio, also used to indicate antennas.*
Eatum-up	*Restaurant or truck stop.*
Eighteen Wheeler	*Semi-tractor-trailer truck (may have more or fewer than 18 wheels).*
Fat load	*Overweight load. Each state has its own load limits.*
Feed the Bears	*Get a ticket.*
Five-five	*55 as in 55 mph.*
Four	*Right.*
Four ten	*Ten-four in spades.*
Four wheeler	*Automobile.*
Front Door	*Lead vehicle watching for Smokies in front of group.*
Grass	*Median or off on side of road.*
Green Stamps	*Money, 1 green stamp - 1 dollar.*
Green Stamp Road	*Toll road.*
Hammer	*Accelerator pedal.*
Hammer Down	*Driving fast, as in: "Put the hammer down."*
In the Grass	*In the median.*
Mercy	*Oh My! Goodness sakes! Imagine that! Wow!*
On the Move	*Traveling.*
On the side	*Pulled over onto the shoulder, (Smokey has a four wheeler) just listening, (I'm . . .).*
Other Half	*Husband or wife, whoever is not speaking.*

Plain Wrapper	*Unmarked police car or state public service car.*
Picture Taker	*Police radar unit.*
Pickum-up	*Pick-up truck.*
Pregnant Roller Skate	*VW.*
Put the Good Numbers on you	*73, 88, etc.*
Rake the leaves	*Last vehicle in a group, bringing up the rear, back door.*
Ratchet Jaw	*Talk for a long time – usually at the wrong time.*
Rest-um up	*Rest area.*
Rig	*Tractor.*
RIG	*Radio (ears).*
Rocking Chair	*Truck (or car) between the front door and the back door. A good place to be.*
Roger Rollerskate	*Driver of a car who is more than 20 mph over the limit; also known as Roger Ramjet, a cartoon character.*
Roller Skate	*Small car, compact, import, motorcycle (rare).*
Seatcovers	*Passengers, especially good looking passengers.*
Six Wheeler	*Car with trailer.*
Smokey	*Any police officer.*
Smokey the Bear	*State Police.*
Smokey with Ears	*Police with CB radio or CB monitor.*
Ten-four	*Whatever the other guy said was absolutely right.*
**Thirty Three 10-33*	*Accident or emergency message.*
Threes on you	*Best regards (73).*
Threes & Eights	*73 & 88 – Best regards, love and kisses (also known as stack them eights).*
Tijuana Taxi	*Police car with lights and insignia.*
Train Station	*Court with high guilty rate . . . kangaroo court.*
Two Wheeler	*Motorcycle.*
Two Way Radar	*Radar which can be used to monitor traffic while in a moving vehicle. Some Smokies are said to have two way ears, no radar but a monitor.*
Wall to Wall Bears	*Any area with heavy police patrol, such as I-240 in Memphis, Tenn., I-94 Berrian County, Mich., the whole State of Ohio, and other areas where the Police enforce the letter of the law to extremes or conduct known traps.*
We Gone!!	*Stopping transmitting and just listening.*

. . . Michigan Radio Doctor
Michigan Mother Trucker

**EMERGENCY MESSAGES HAVE PRIORITY OVER ALL OTHERS.*

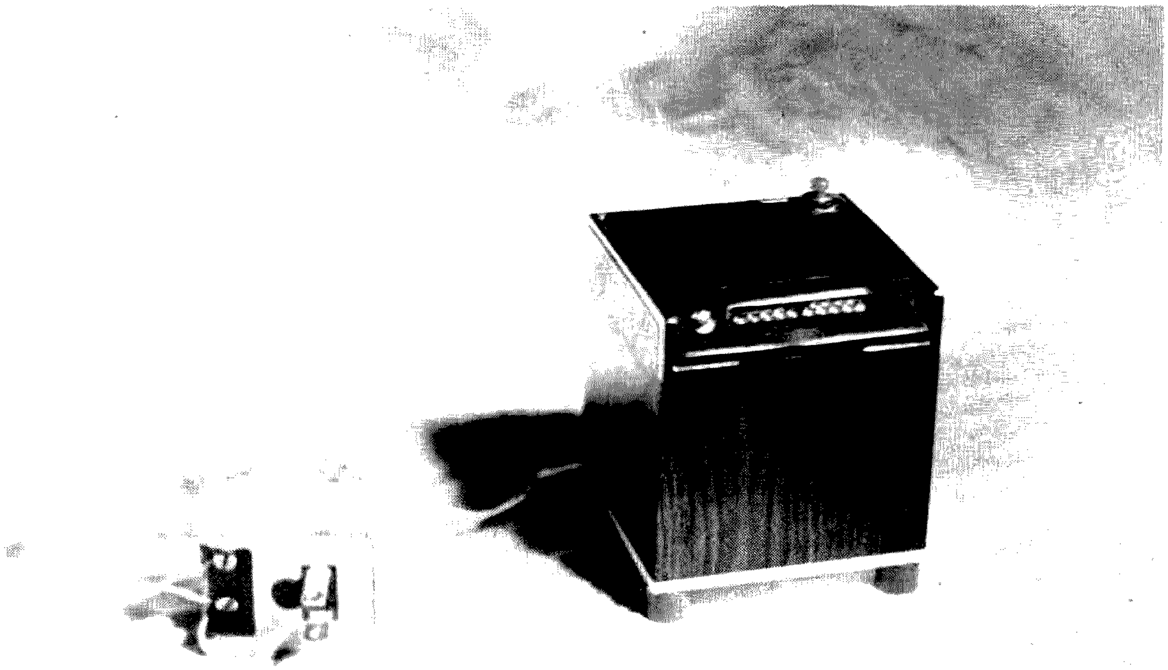
Warren MacDowell W2AOO
11080 Transit Road
East Amherst NY 14051

The Wonderful Mini-Chronometer

The state of the art in electronics miniaturization for digital clocks has evolved to the point where digital crystal controlled wrist watches are now commonplace. For the average cheapskate such as myself, a $200.00 digital wrist watch is out of the question. What I am about to describe however, is a miniature digital alarm clock that will fit in a 3 inch square cube – power supply, readout, speaker and all.

This compact clock could possibly be constructed in a Zippo lighter case if printed circuit techniques were *not* employed. The power supply and alarm speaker would then have to be remote and you might well be wearing 1" thick bifocals after completing this project.

Anyway, my particular mini alarm chronometer was constructed in the discarded case of a defunct Radio Shack Weather Radio. The entire cube shaped case has the internal dimensions of about 3 square inches. When completed, this little beauty contained power supply, 10 digit LED readout (6 used), an alarm speaker and all necessary switching.



Complete clock, power cord and "power plug" transformer. The case is that of a discarded Radio Shack Weather Radio.

The only external component was the power transformer which serves also as a power line plug. This particular transformer is a telephone company encapsulated 6-8 V ac unit, with wall plug built in. If I am not mistaken, these are used to provide dial light power for "Princess" telephones. Our particular transformer just happened to fall out of a passing telephone company truck and they never returned to claim it. This encapsulated transformer is self current limiting (short proof) and, therefore, does not require a line fuse for the completed clock. If you don't have many phone company trucks passing your home, a conventional miniature 6.3 V ac, 500 mA filament transformer (imported type) can be fitted into the 3" cube with all necessary space to spare. Then, the only component external to the clock will be the line cord and "conventional" wall plug.

The current drain of the entire clock is very low and well within the requirements of this small transformer. The greatest "current hogs" in digital clocks tend to be the LED readouts. A garden variety large single LED can draw as much as 20-30 milliamperes per segment, of which there are seven. This gives you a grand total of 210 milliamperes (worst case) when all segments are illuminated.

Once again, the state of the art in LED readout manufacture has created very small encapsulated bubble (magnified) type devices containing 5 complete seven segment readouts. This entire 5 digit readout plugs directly into a common 14 pin DIP integrated circuit socket. Our particular readouts were obtained from Radio Shack for about $2.98 per device (2 required). For those with Radio Shack stores nearby it is part #276-059 (7 Segment Monolithic 5 Digit Numeric Display).

The average current per segment in these displays is about 5 milliamperes. That results in 35 milliamperes total per 7 segment digit (worst case) and 210 milliamperes (worst case) for all six digits when totally illuminated. Built-in magnification of the self-contained plastic bubbles provides excellent readability and the total life span of the device is comparable to any other LED device.

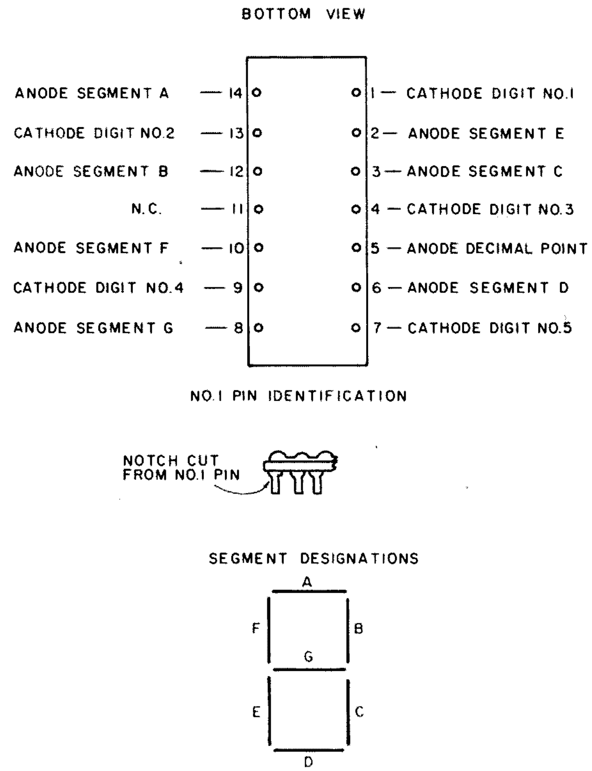


Fig. 1. 5082 readout pin connections.

These readouts are internally designed for strobed or multiplex operation. This means that the individual digits have separate pins or connections and the segments are all connected in parallel with a common pin connection.

In multiplex or "scanning" operation, the individual digits are turned on (pulsed) at a very rapid rate and at the same time, appropriate segments are also turned on. In this way, even though the segments are wired in parallel, the scanning action gives you the illusion of separate digits. The scanning rate of course is much faster than the eye can follow but well within the repetition (frequency limit) that the LEDs can follow. Pin connections for the Radio Shack part #276-059 are illustrated in Fig. 1.

The integrated circuit clock chip that we used is the Mostek 50250 (Radio Shack part #276-1715). This IC can be used to drive either a four or six digit display. In our opinion, the 6 digit display is much more impressive, accurate and useful, especially for amateur applications. The 50250 has both 12 and 24 hour timekeeping capabilities. The 12 hour timekeeping format requires a 60 cycle input as a clock fre-

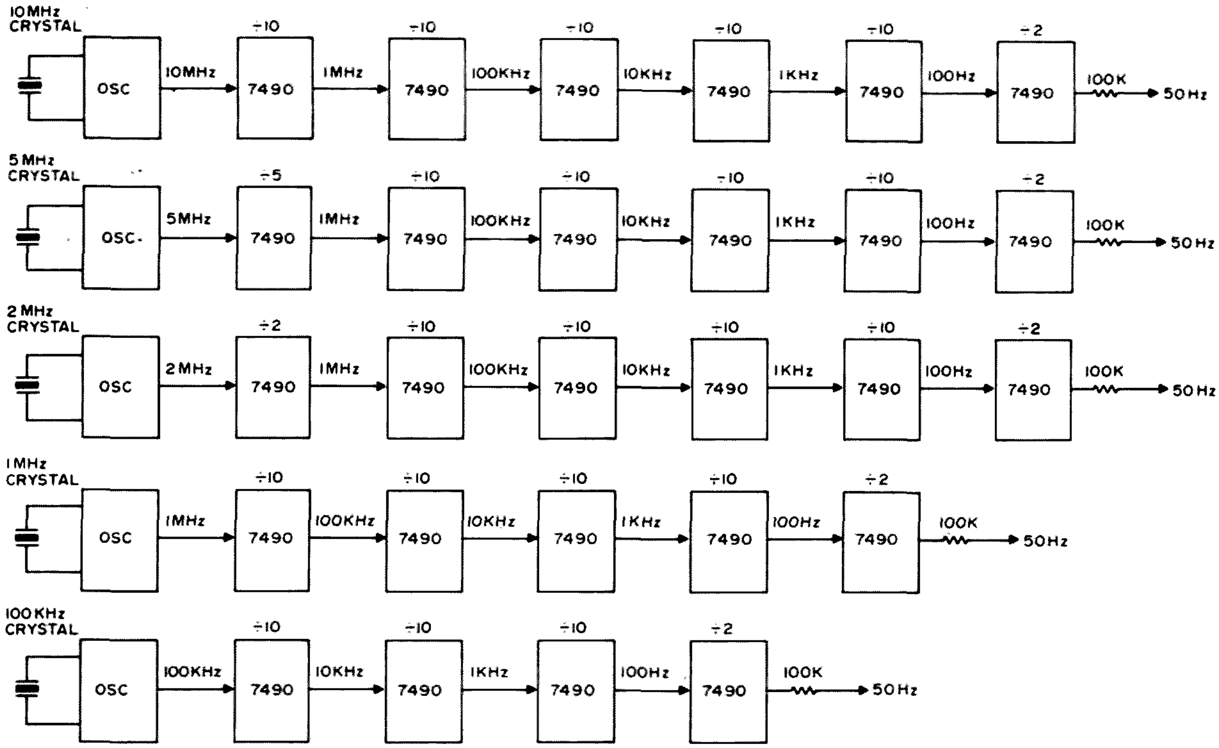


Fig. 2. 50 Hertz crystal time base ideas.

quency source. In other words, for normal timekeeping the 60 cycle line frequency must be sampled by the IC. The clock accuracy is thereby directly affected by the 60 cycle power line frequency. When the power fails, the clock loses its frequency source and timekeeping also fails.

For the 24 hour timekeeping function, the 60 cycle power line reference cannot be used. The 24 hour format requires a 50 cycle frequency source. The 50 cycle frequency source lends itself well to a crystal time base for the clock and excellent accuracy. By using a few other inexpensive TTL (transistor-transistor-logic) integrated circuits, a 10 MHz, 1 MHz, 100 kHz or other crystal oscillator may be divided down to provide the necessary 50 Hz reference. See Fig. 2.

The most common and available crystals are those of 100 kHz and 1 MHz. the majority of amateur receivers have a built-in calibrator crystal at 100 kHz. Removing this crystal for use as a clock frequency source will not destroy its function as a calibrator. In fact, by constructing the clock source, you now have frequency references at 100 kHz, 10 kHz, 1 kHz, etc. The clock, while running in normal operation, will radiate calibration signals. While operating, this can become an annoyance. Therefore, shielding of the clock may become necessary if placed near your station receiver. Crystal sources may be divided down to provide 60 Hz but oddball crystals are generally required. It is much easier to use the 60 Hz power line source for the 12 hour format.

The 50250 is really designed for operation as an "alarm clock" chip. With proper interface to a speaker, it will generate a *loud* 1 kHz beep at one second intervals until the

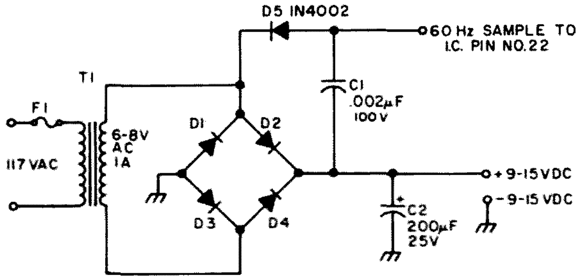


Fig. 3. Power supply.

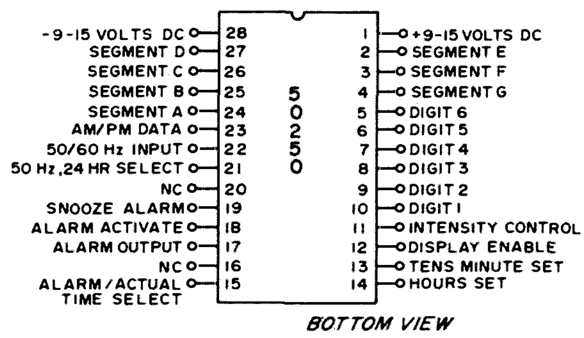


Fig. 4. 50250 pin connections.

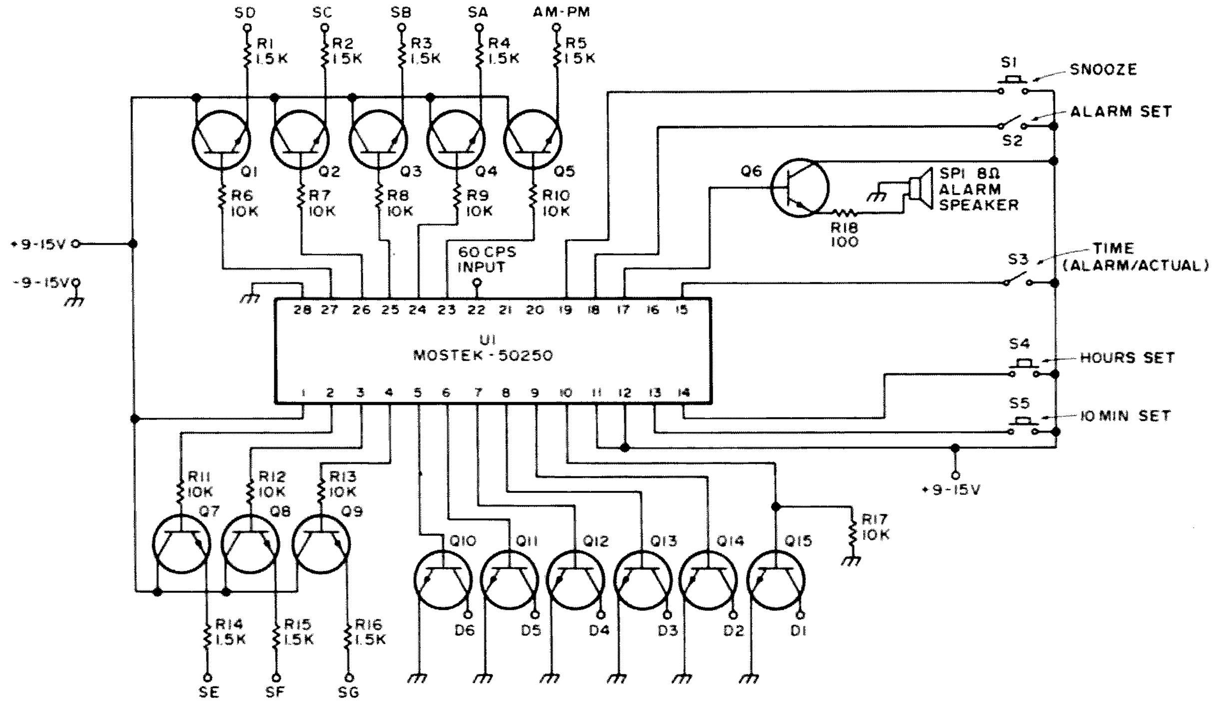
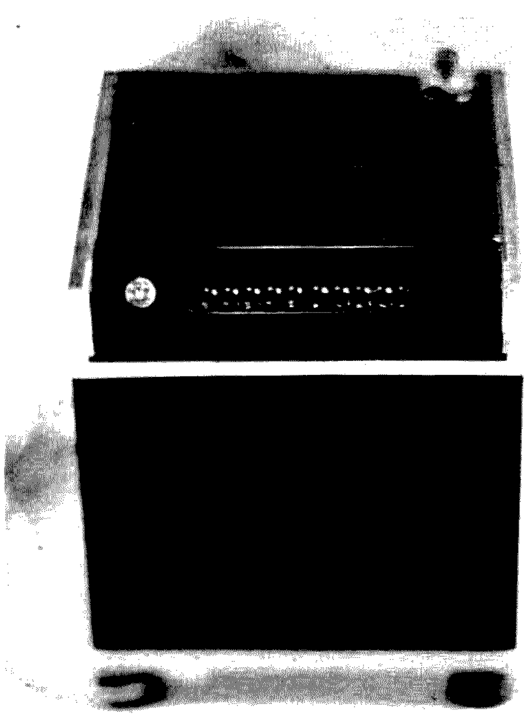


Fig. 5. Schematic.

alarm circuitry has been reset. The alarm operates in a 24 hour mode which allows you to disable and immediately re-enable the alarm to activate 24 hours later. Also built in is a snooze alarm for a period of 10 minutes upon which the alarm again sounds. The snooze alarm may be reset repeatedly at 10 minute intervals.



Mini chronometer readouts mounted in black plastic sheet.

Fig. 3 illustrates the power supply required to run the clock. T_1 is either a telephone transformer or a miniature 6.3 ac, 500 mA filament transformer. Of course, the phone transformer is more convenient as it doubles as a wall plug. D_1-D_5 are 1N4002 silicon rectifiers. Here, any 50 volt or more, 1 Ampere silicon rectifier will suffice. An encapsulated bridge rectifier rated at the same is also convenient to replace D_1-D_4. D_5, which acts as a half wave rectifier, provides the 60 cycle sample (clock) source for the IC. C_2 may be 200 uF at 25 volts or more; 200 uF is just about the low limit for proper filtering. A 1000 uF or higher value may also be used. Depending on the transformer used, (6 or 8 V ac) the dc output voltage should range anywhere from 7.5 to 15 volts dc.

Fig. 4 shows the pin connections of the 50250. This is a bottom view with pins upward.

Fig. 5 is the complete schematic with the exception of the readouts. The 50250 emanates a positive pulse for activation of both digits and segments. Therefore NPN transistors were used to interface the 50250 with the outside world. The IC by itself does not have the power handling capabilities to drive LED readouts directly, therefore higher power transistors must do the actual

switching. All of the NPN switching transistors used were those obtained from the Radio Shack Quad Pack (Part #276-530) and were NPN medium power general purpose. The snooze, hours set and 10 minute set switches are of the normally open type of push-button.

The actual size printed circuit board shown in the figures can be photographically reproduced and made up; however, for a single clock, this process seems hardly necessary. We generally take a template such as this and cut a piece of PC board stock the same size. Scotch tape is then used to hold the template on the PC board. A sharp punch is used to indent the copper at all points where a hole is to be drilled or component inserted. When the pattern is removed, the punch marks will be in exact position. Ordinary finger nail polish and a fine brush are then used to "paint between the dots" and duplicate the original pattern. The nail polish dries very fast and is an excellent resist. The board is then placed in a heated ferric chloride solution which rapidly removes the excess copper. The nail polish resist is then removed with nail polish remover or "Stripeze" (paint remover). The initial punch marks now serve as center-punch guide holes when you drill all the holes (#56#60 drill). All necessary components with the exception of the power transformer and readouts are placed on this board.

Fig. 7 shows where transistors and diodes are inserted on the PC board. Make sure you use the 50250 socket. It would be very difficult to remove a defective 28 pin IC should it be defective. The NPN Radio Shack transistors used do not have the conventional lead connections as do normal garden variety transistors; therefore, we have illustrated where the "flat" side of the transistor is placed to correctly orient the leads. All parts are inserted from the non-foil side of the board. As you insert the components, solder them in place with a 25 Watt fine tip iron and trim off the excess leads close to the PC board.

Fig. 8 illustrates the placement of the encapsulated rectifier bridge, as well as the resistors and capacitors. Individual 1N4002 silicon diodes may be used, although the encapsulated bridge is a much more convenient device. The bridge we used was a 50 piv, 1 Ampere unit which is also a Radio Shack device. The .005 capacitor is a small ceramic disc type rated at 50-100 volts. The 200 uF 35 volt filter capacitor is small enough to be placed flat on the PC board, and polarity must be observed. Only one jumper is

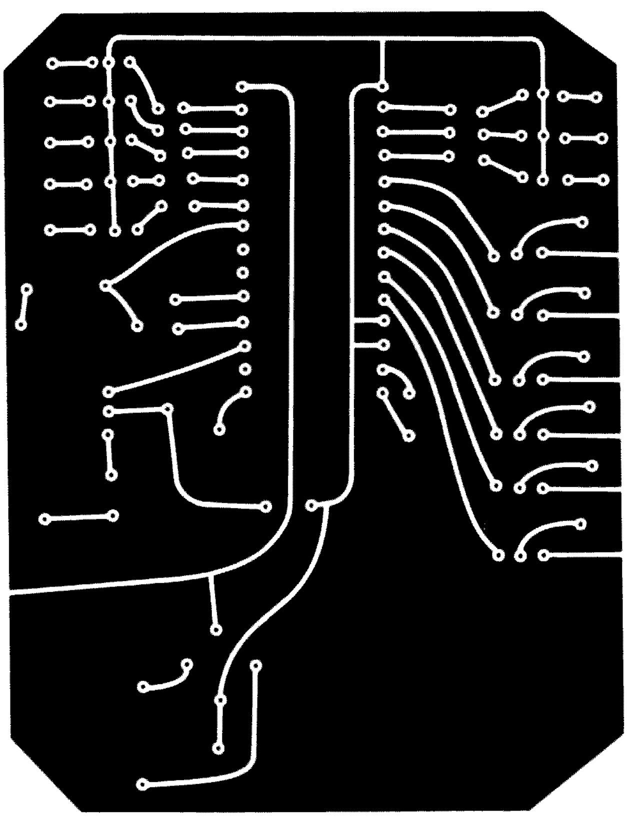


Fig. 6. PC board (full size).

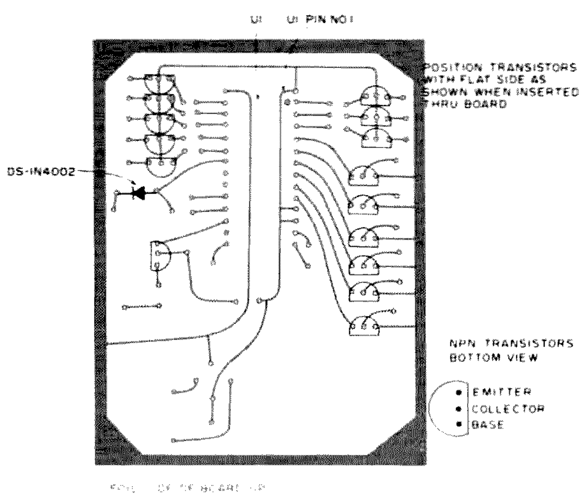


Fig. 7. Transistor and diode placement. Transistors are NPN, medium power from $1.98 Radio Shack Quad Pack #276-530.

Full size negatives for Fig. 6 are available for $2.00 each from PC NEGS, 73, Peterborough NH 03458. Order #W2A00-1.

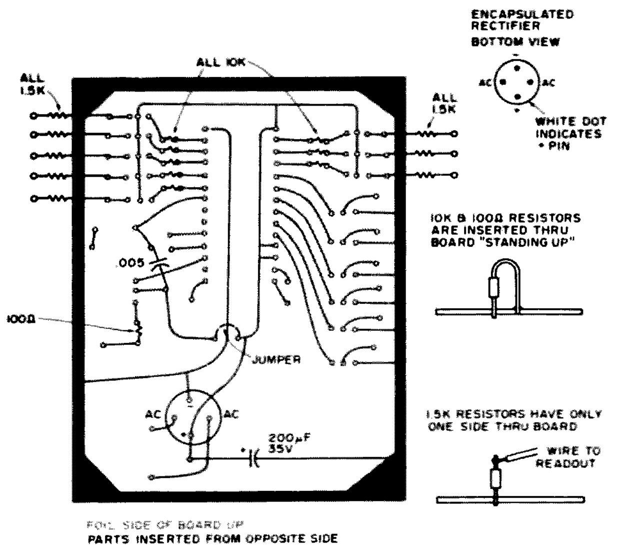


Fig. 8. Rectifier and resistor placement.

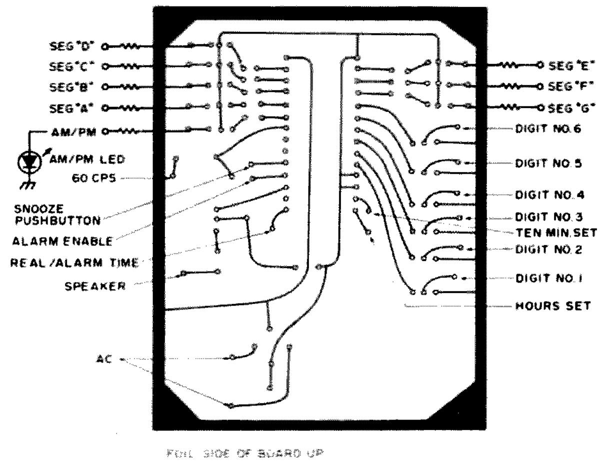


Fig. 9. External and time function/control switch connections.

necessary on the board and may be any small piece of copper wire. The 10k resistors and the 100 Ohm resistors are inserted "standing up" so as to conserve space. The 1/8 Watt resistors stand up about 1/2" high. The 1.5k resistors also are inserted in the board "standing up" and soldered. The opposite end is trimmed off leaving about 1/8" of lead on the resistor. A wire going to the proper readout must be soldered to this standing resistor lead. This was used to conserve PC board space. To really conserve on space, the PC board may be cut off so that the encapsulated bridge and 200 uF capacitor are separate (with appropriate jumpers made up). This is necessary to squeeze the board into the 3" square cube, if these are your plans.

Fig. 9 shows the external and time function control switch connections. The digit wires are soldered directly to the board. All of the segment wires are attached to the top lead of the 1.5k resistors previously soldered in place. The 60 cps connection can either go to an external 60 cps frequency source such as a crystal frequency divider or to either of the ac points on the PC board for a 60 cps sample (jumper). The speaker terminal goes directly to an 8 Ohm miniature speaker and the other speaker connection returns to ground or the edge foil of the PC board. Holes may be drilled in the corner section of the PC board for mounting it on standoffs.

The opposite side of the time function control switches is attached to the +9 -15 volt lead. Refer to the main schematic (Fig. 5) for the type of switch and connections.

After you have wired and completed all the previous goodies no doubt you have had your bifocal prescription modified as well.

Once power is applied, there are two possible things that will happen. The clock will either smoke and immediately burn up, or the numbers 12:00:00 will appear when the switch for real/alarm time is in either position. Luck is with you and the phases of the moon are correct if you obtain the 12:00:00 reading. Don't let it frighten you if the seconds are not counting when first obtaining a display. Both the hours and ten minute push-button switches must be depressed simultaneously to begin the time-keeping function with the real time/alarm switch in the real time position. If there is leak over between digits, it means you have a transistor that has excessive leakage in your driver stages. It is quite common to find a "lemon" in the transistor drivers.

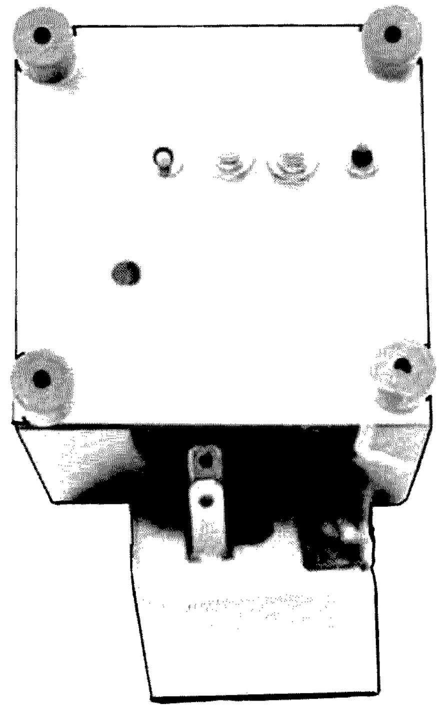
Anyway, it takes a bit of practice to get used to setting the clock with the hours and ten minute switches. Once you have become proficient at this, it is time to experiment with alarm. We should have mentioned previously that an am-pm LED should have been attached as shown in Fig. 9. This may be any small LED connected to the am-pm transistor driver. When the clock is in the am mode, this LED will illuminate. The main purpose of this LED is to allow you to set the alarm function properly. If you place the alarm/real time switch in the alarm position,

the LED will come on if you desire am alarm settings. The same switches used to set the alarm time are used to set the real time. When the alarm enable switch is in the enable position, the alarm will sound with a loud one second beep when the real time has reached the alarm set time. The snooze alarm switch, if depressed when the alarm goes off, will allow 10 minutes of silence before the alarm sounds again. This may be repeated indefinitely until the alarm enable switch is shut off. If you wish, this feature may be incorporated as a 10 minute timer for station indentification.

With the alarm system, there are two characteristics that should be avoided. The alarm should not be exactly set at 12:00 am or 12:00 pm or 8:00 am or 8:00 pm. Setting the alarm a few minutes before or after these times will allow reliable operation.

Should the local line power drop below a usable level, the am/pm LED will blink at a 1 cycle rate. This tells you the clock has lost time or needs to be reset correctly.

This clock should be an interesting project to construct and will serve you well. At



Bottom view of mini chronometer, showing time set push-buttons and alarm/real time switches.

the very least, it will give you considerable insight into the functions of large scale integrated circuits and their capabilities. The state of the art in electronics is no further away than the tip of your soldering iron (25 Watt fine tip).

Parts List

Fig. 3.

C1 – .002 uF 100 V capacitor
C2 – 200 uF (or higher)
D1-D5 – 1N4002 silicon diodes. A single encapsulated bridge (50 V @ 1 A) works well also.
F1 – 1 A 125 V slow blow fuse
T1 – Plug in Princess telephone transformer, 6-8 V ac, 1.75 VA secondary, 117 ac primary (or 6.3 ac 500 mA filament transformer)

Fig. 5.

Q1-Q15 – Radio Shack (Archer) #276-530 transistor quad pack ($1.98). Use the NPN medium power general purpose transistors (6 per pack). There are 24 transistors (assorted) in each pack, the remainder of which make good spares, etc.
R1-R5, R14-R16 – 1/8 Watt, 1500 Ohm carbon resistors
R6-R10 – 1/8 Watt, 10,000 Ohm carbon resistors
R18 – ½ Watt, 100 Ohm carbon resistor
S1, S4, S5 – Normally open miniature push-button switches
S2, S3 – Single pole miniature toggle switches
SP1 – 8 Ohm 2 in. speaker
U1 – Radio Shack #276-1751 MOS-LSI Digital Alarm Clock IC

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73 Magazine Staff

An Accessory VFO - The Easy Way

Most amateurs who use an HF transceiver at times desire having an accessory VFO for separate VFO control of the transmitting and receiving frequencies. If the transceiver does not have receiver incremental tuning, the addition of an accessory VFO becomes an even more desirable item. Accessory VFO's can be purchased for most transceivers, of course, but their cost can be a considerable fraction of the original cost of the transceiver since the accessory VFO usually duplicates the stability, housing and frequency scale readout of the transceiver's VFO.

The accessory VFO circuits described in this article can be developed into full-scale accessory VFO's but there is another possible use for them with a transceiver which requires far less work and yet provides most of the advantages of a regular accessory VFO. As was just mentioned, most regular accessory VFO's duplicate the transceiver VFO and one can use the transceiver or accessory VFO interchangeably since they both have the same frequency calibration scales. Another approach to the use of an accessory VFO would be to tune the transceiver (using the transceiver VFO) to a desired transmitting frequency, switch on an accessory VFO which can be zero-beated to the transceiver's VFO frequency and then switch VFO control of the transceiver in the *transmit* mode to the accessory VFO. In the receive mode the frequency control of the transceiver would remain with the transceiver VFO and could, of course, be tuned as desired. This scheme requires only the use of a stable, external VFO *without* elaborate frequency readout, which can be zero-beat with the transceiver VFO and which can be switched in the transceiver to assume frequency control of the transceiver during transmit periods. The circuitry to do the latter is already provided in any transceiver which has provisions for the use of an accessory VFO. To zero-beat the external VFO with the transceiver VFO, the external VFO signal is introduced to the transceiver in the receive mode as though it were a regular received signal, and the external VFO tuned for zero-beat. With most transceivers the level of an external VFO is usually great enough so it can be introduced at the antenna terminals of the transceiver and not be severely affected by the selectivity of the

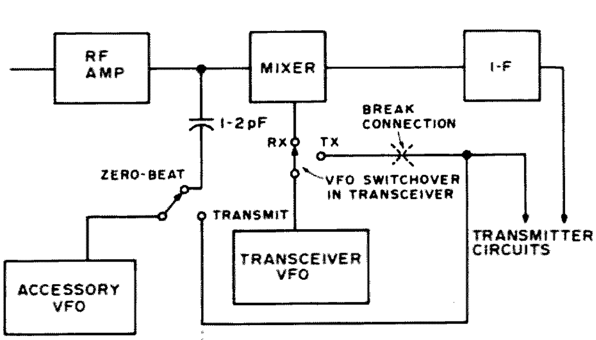

Fig. 1. Basic use of accessory VFO.

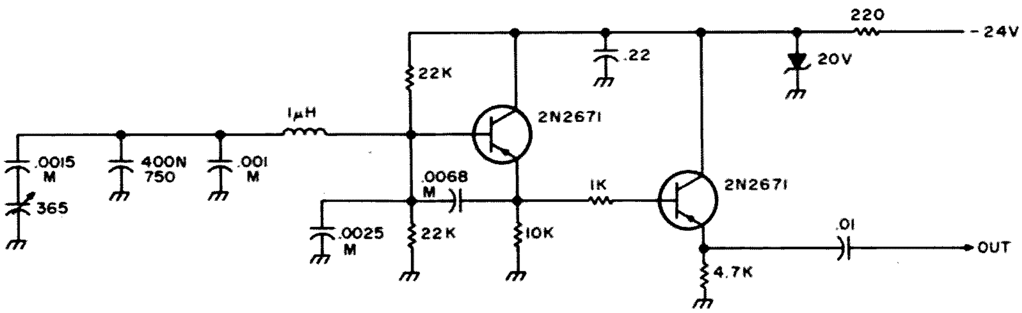

Fig. 2. An old fashioned (PNP transistors) but extremely stable VFO. Basic oscillator frequency is 5 MHz with about a 250 kHz tuning range. Capacitors marked "M" must be silver mica type.

circuits in the rf amplifier stage. So, it can be used to zero-beat with the transceiver VFO.

If, however, an effective zero-beat cannot be obtained, the external VFO signal can be introduced directly to the input of the mixer stage which the transceiver VFO also feeds. The amount of the coupling required is usually very light and can be effected via a simple 5 to 10 pF capacitor coupling from the external VFO. This method will work with any transceiver where single conversion is used, such as the usual 9 MHz i-f transceiver. Unfortunately, it is not possible to present the VFO switching circuits available in every transceiver but if the general switching idea outlined is followed and experimented with, there should be no difficulty in making a satisfactory connection to one of the VFO circuits to be described.

Fig. 1 illustrates the transceiver switching idea involved. The rest of this article describes several circuits suitable for external VFO usage. Each is quite stable and can be adapted to work over any of the ranges suited to an HF transceiver – namely, a 250 to 600 kHz range within any selected portion from about 4 MHz to 12 MHz. The various circuits have their own advantages and disadvantages depending both upon what components one already has available and on the tuning method desired.

Fig. 2 illustrates a rather old fashioned VFO, in a sense, since PNP transistors are used. But, it is an extremely simple and stable circuit. The tuning range is about 250 kHz in any segment of the 5 to 9 MHz range depending upon how the oscillator coil is set. It is a high –C type circuit and so the oscillator coil is relatively small in value. The coil, however, should be wound on a ceramic coil form or be an air-wound coil. The capacitors noted in the circuit *must* be mica types to ensure stability. The tuning capacitor is a very easy to obtain 365 pF AM radio tuning variable. The 400/N750 temperature compensating capacitor shown is not absolutely necessary and may be a difficult component to obtain although it is not expensive. It can be replaced by a regular 400 pF mica capacitor. The only instance in which this capacitor is necessary is if the VFO is to be used in a mobile application. In that case, it should be placed near the VFO coil to achieve maximum temperature stability of the oscillator. A positive supply voltage could be used by grounding of the collector circuit and feeding the positive supply voltage via the emitter resistors of each transistor. Because of the high capacitance loading on the oscillator tank circuit, the 365 pF tuning capacitor need not be located directly adjacent to the VFO. It can be coupled to the VFO via a short length of shielded cable (RG174) if this is more convenient in a given transceiver.

The circuit of Fig. 3 is a bit more conventional in that it operates from a positive 12 volt dc source. The VFO coil is air-wound and consists of 17 turns of #18 wire, 5/8" in diameter, or the B&W coil stock

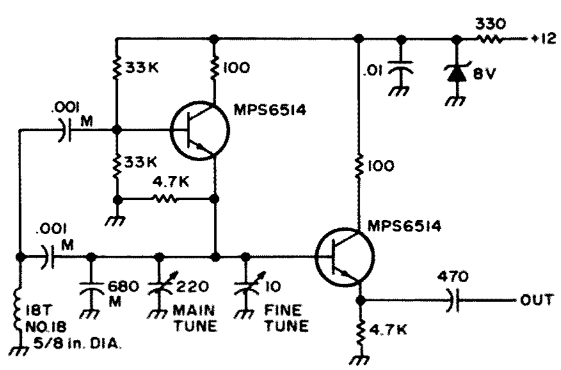

Fig. 3. This oscillator tunes about 500 kHz starting at 5 MHz. Only three silver mica capacitors are required.

equivalent. The oscillator operates at about 5 MHz with the main tuning control covering a 500 kHz range and the fine tuning control covering a ± 20 kHz range. The oscillator can be made to operate over almost *any* position of the HF range by proper selection of the coil. Note that mica capacitors *must* be used for the two .001 uF and one 680 pF capacitors associated with the oscillator coil. The output at the emitter coupling capacitor of the buffer stage is a relatively high 4 volts peak-to-peak.

The circuit of Fig. 4 is extremely interesting in that it requires no tuning capacitors (and no varactor diodes) and provides tuning over a small tuning range (about 50 kHz centered on 7 MHz). It would be very suitable for someone interested in operation over a particular portion (CW or phone) of one band. Although there are no varactor diodes in the circuit, as such, the collector to base junctions of the two 2N3053 transistors perform the same function. The circuit requires a minimum of critical components. Only the three capacitors marked as being "M" must be of the silver mica type. If one wanted to considerably expand the frequency bandspread of the oscillator (to about ± 250 kHz about the center frequency), the 130 pF "M" capacitor could be replaced by an air variable and the potentiometer tuning still be retained for fine tuning. This modification would not change the very good basic frequency stability of the oscillator and only two silver mica capacitors (50 and 380 pF) would be required for the whole oscillator circuit.

Fig. 5 is another oscillator circuit that has been widely used, especially in QST articles. It is the same type of oscillator as the preceding one but includes an emitter follower buffer stage for isolation. The emitter follower stage contains a low pass

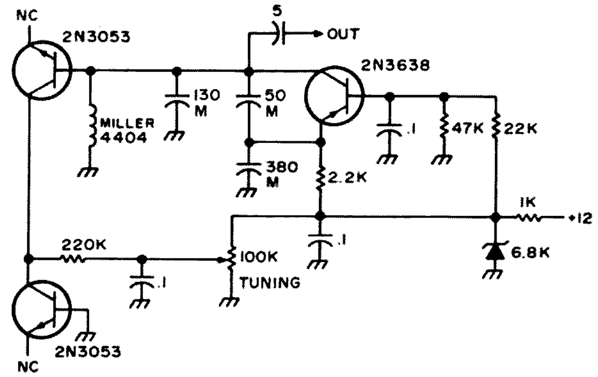

Fig. 4. This interesting VFO tunes only about 50 kHz starting from 7 MHz. It can be modified for greater range.

filter to reduce harmonic output and produce a better sine wave output waveform. It is not really necessary if the VFO is to be used for transmitting control only. The oscillator coil should be enclosed in a shield at least twice as wide as the oscillator coil diameter. Such a shield can be assembled by soldering together pieces of copper clad circuit board. With the components shown, this oscillator tunes from about 4000 to 4600 kHz. It can, of course, be modified to cover other frequency ranges. If one wanted to try the oscillator without the buffer stage, the 33 pF mica should be connected instead to the junction of the two 1,000 pF mica capacitors and the output taken from this point.

This article presents a variety of oscillator circuits to be used as a transmitting control VFO in the manner described. Each of the circuits has been tried and proven. The main precautions to be used in the construction of any oscillator is to use a good quality, rigid oscillator coil (cemented air core or wound on a ceramic form) and to use silver mica capacitors at the locations specified. Styroflex capacitors may be used as substitutes but never disc ceramic types. If the VFO is used to zero-beat with the transceiver VFO,

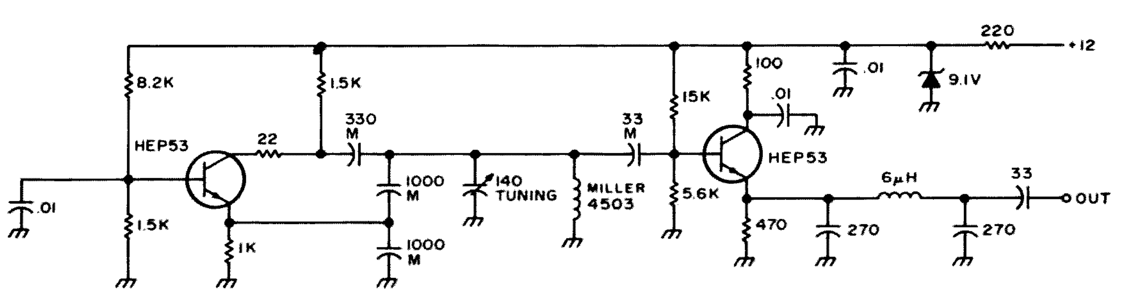

Fig. 5. This oscillator tunes over about a 500 kHz range. Both transistors are HEP 53.

a frequency readout scale on the accessory VFO is *not* really required once one is sure of its frequency range. Construction can, therefore, be extremely compact in any form of shielded enclosure.

The last point to check is that the accessory VFO has sufficient output level. One should, of course, check the VFO output level necessary with a transceiver before building the accessory VFO. Most of the oscillator circuits shown will provide several volts peak-to-peak output and should suffice for almost any requirement. If the oscillator is to be used only for transmitting control as described, the criterion for proper oscillator output is quite simple. The transmitter output level and signal quality should be the same as when the transceiver VFO is used for frequency control in the transmit mode. These qualities are fortunately quite simple to check using the transceiver's meters and on-the-air checks. The situation in checking such a VFO for receiving control is far more difficult to evaluate and usually demands a good array of test equipment.

...STAFF

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Modern Non-Morse Codes

Like ASCII and such

Digital information may be in the form of individual on-off signals, or it may be encoded. And if encoded, it may be serial or parallel. The serial format consists of various bits of information in one place at different times, and parallel has the various bits in several places at the same time. For example, a RTTY signal is serial, a series of pulses in order. Within the machine, the information is converted from electrical to mechanical information, in a parallel format. Punched tape is a parallel format as well (bit-wise anyway; complete characters are arranged in a series).

There are a number of encoding schemes of interest to amateurs, the first of which is Morse. This is generally found in serial form only, but these days not always. Others are Baudot, the old five-unit-plus-context teletypewriter code, and the American Standard Code for Information Interchange (ASCII), eight-unit, or seven-plus-parity actually, also used for TTY and computers as well. This pretty well takes care of the Major Leagues. There are other codes used for computers, notably EBCDIC (Extended Binary Coded Decimal Intercommunication Code), IBM's favorite; Univac's entry, Fieldata; Hollerith (used on punch cards but almost nowhere else – the punch card was invented by Mr. Hollerith in the late 19th Century and exists today basically unchanged except for the addition of numerous characters, including my favorite, the lozenge); TTS (teletypeset), a six-bit version of Baudot used, as its name implies, in typesetting, with or without computers; and the Friden Flexowriter code. These also belong in the Majors, but are not generally of interest to hams.

The Minors include BCD, Gray, XS3, XS3 Gray, Touch-Tone, MFKP (Multi-Frequency Key Pulse, the operator's Touch-Tone), 2-4-2-1, biquinary, straight binary and its alter egos octal and hexadecimal. These are all simple systems which basically represent only numbers. In the case of MFKP there are two extra combinations representing the start of a sequence, called KP, and the end, called Start. And TT has asterisk (*) and hash mark (#) and four nameless combinations.

Then there are the bush leagues – an endless variety of possibilities, tailored to the applications. Any time you have more information than wires, and sometimes even when you don't, you have a code. Without encoding, for example, 10 wires can embody 20 functions in pairs, such as on-off, up-down, etc. This has the advantage that all of them are completely independent – or sometimes the disadvantage. But encoding gives those same 10 wires a maximum capacity of 1024 functions, or 2^{10} instead of 2 x 10. This does not mean that you have to lose any sleep over some of those possibilities going to waste, and often unused combinations provide elbow room, making it

easier to work with a code scheme. Of course, now that we have implemented a code, the whole system can represent only one function at a time. If this is a problem, the information can be partially encoded, with various subgroups of bits assigned to various functions of groups of functions, while the whole 10 (or whatever) bits can be used for others. You can even make the subgroups (called bytes) talk to each other – such as carry or borrow signals when performing arithmetic functions in a calculator circuit, or override signals for shutting down the carcinotron when the klaveman goes south.

Definitions

Before going any further, I ought to define some terms I have already used.

Context: In the Baudot code, two of the 32 possible combinations of five bits are assigned to shift between two sets of meanings for most of the rest of the code. When a Shift or Unshift character is received, it is stored, either mechanically or electrically, and must be considered when deciding what the subsequent code combinations mean. A particular combination means either the letter Y or the numeral 6, and you can look at it all night and not know, unless you know the context in which it was sent. Of course you can take a whole line without shifts (and sometimes you have to), try it both ways and see which way it makes sense, but that is just a more complex way of arriving at the same information. You still have in any given character five bits of text and one of context; almost like six for the price of five, but it helps to at least say so each time you change from one context to the other. TTS, meanwhile, sends all six and uses shifts to expand the code, to handle lower case letters and functions peculiar to typesetting.

Parity: In ASCII and several other codes, an extra bit is included to check for errors, and sometimes several bits are added (more about that later). It is much more likely that a noise burst will clobber one bit than two, so all the information bits are added up, and a parity bit is added so that the total number of "on" or "1" bits will be even, or odd, depending on the system – but once established, it does not change. If the system is Even Parity and a character whose info bits are 1101100 is to be sent, a zero bit is tacked onto the end, giving 11011000. If the next one is 1001111, that's odd, so we add a 1 and get 10011111, which is even. This is a simple error-checking system, and it is possible for multiple errors to sneak through, as long as they alter an even number of bits. But a noisy circuit will show its hand pretty quickly anyway.

Binary: There are actually two slightly different meanings floating around. Generally it refers to a number system or representational system, each element of which can be in one of two states. The states can be called mark and space, one and zero, high and low, true and false, A and $\overline{A}$ (not -A), or even Mark and Fred. Whatever you call them, as long as there are two of them, it is binary. A code can be binary while having little or nothing to do with numbers – ASCII is a binary code, even though only 10 of the 128 combinations represent numbers. The other shade of meaning is specifically the base 2 number system, where the digits are 1 or 0, where a 1 has a numerical value of some power of 2. Whenever there is a possibility for confusion, you can add a word, and say straight binary or something like that to indicate the second meaning.

Octal: This is binary in disguise, and consists of using the base 8 system, with the digits 0-7, as a shorthand to indicate three-bit groups of binary, 000 through 111. Programming languages such as Fortran allow for using octal representation anywhere desired, when indicated by sticking a leading zero on the number. Thus 0427 = 427_8 = 100 010 111_2. (Subscripts are not available on a TTY.) Similarly, I often use a pair (or more) of leading zeros to indicate base 2. So 010 = 10_8 = 8_{10}; 0010 = 10_2 = 2; but 10 = ? When the scratch pad gets full, it helps to have some indication.

Hexadecimal ("Hex"): This is another disguise like octal, but bits are grouped in fours, giving sixteen combinations. The digits 0-9 are used, and the letters A-F; e.g. A_{16} = 1010_2 = 10_{10}. Neither octal nor hex has any effect on the binary code itself.

BCD: This stands for binary coded de-

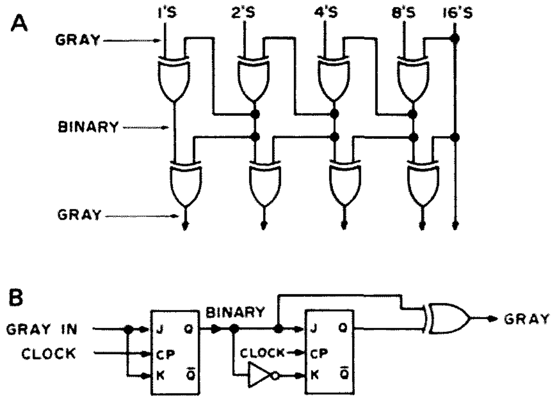


Fig. 1. A) Parallel: Gray to binary to Gray (for XS3 – XS3 Gray, delete one gate); B) Serial (most significant bit first).

cimal. Any number can be expressed in any format, and they all have their advantages. Straight binary is most suited to the internal workings of computers, but it's harder for humans to use than decimal. BCD groups the bits in fours, and the first group on the right represents the same value in hex, namely 8-4-2-1, but the largest number represented is 9, with the six remaining combinations defined as meaningless. Thus 0101 = 5, but 1101 = error. The tens digit of a decimal number is represented by another group of four bits with the values 80-40-20-10, and so on. So 0101 0000 then means 50, and 73 comes out as 0111 0011.

Some other decimal/binary crossbreeds are 2-4-2-1 and biquinary (5-4-2-1). The latter gives a symmetrical cycle in the most significant bit, and some decimal counters, such as the 7490, can be connected for this code output or for BCD, as desired.

Gray code: This is a modified binary code having only one bit changing at a time when going from one number value to the next higher or lower. If you wish to encode the position of a shaft, for instance, BCD and binary have serious drawbacks. In either base, for instance, changing from 7 to 8, 0111 to 1000, has four bits changing at once. The changes will never be truly simultaneous, making errors just about inevitable. If only one bit changes at a time, the only possible outputs are the two codes on either side of the transitions.

XS3 (Excess-3): This is BCD code except that the literal value of the code is offset +3 counts. This is useful in decimal arithmetic, since the inversion (trading 1's for 0's) of any number produces the nines complement of that number (9-n), greatly simplifying subtraction.

XS3 Gray: Decimal position encoding with regular Gray code would have a three-bit transition between 0 and 9, but XS3 Gray has only a one-bit jump there. Conversion to BCD involves two steps: first to XS3 with a string of exclusive-or gates (if parallel format) or a JK flip flop (serial); then from XS3 to BCD by subtracting 3

Decimal	Binary	Octal	Hex	BCD	XS3	XS3 Gray	Gray
0	0000	0	0	0000	0011	0010	0000
1	0001	1	1	0001	0100	0110	0001
2	0010	2	2	0010	0101	0111	0011
3	0011	3	3	0011	0110	0101	0010
4	0100	4	4	0100	0111	0100	0110
5	0101	5	5	0101	1000	1100	0111
6	0110	6	6	0110	1001	1101	0101
7	0111	7	7	0111	1010	1111	0100
8	1000	10	8	1000	1011	1110	1100
9	1001	11	9	1001	1100	1010	1101
10	1010	12	A	——	——	——	1111
11	1011	etc.	B	——	——		1110
12	1100		C	——	etc.		1010
13	1101		D				1011
14	1110		E				1001
15	1111		F				1000
16	10000		10				11000
17	10001		11				11001
18	10010		12				11011
etc.	etc.		etc.				etc.

Table I.

(another whole subject). Gray to binary conversion is the same as the first step here. Binary to Gray or XS3 to XS3 Gray uses the same parts with different connections.

BCD is a *weighted* code, meaning that a 1 in any given position always has the same numerical value, or weight. Gray is a non-weighted code; an individual bit does not have a value by itself, but the whole group of bits does.

In addition to the codes themselves, there are transmission schemes (though they are sometimes also called codes) with a lot of strange terms. Starting with the standard RTTY signal for illustration, this could be described as an alphanumeric code (letters and numbers), serial asynchronous (also called start-stop; a zero bit is sent for a start signal and a 1 bit for stop; timing is suspended between the stop and the next start), NRZ, or Non-Return-to-Zero, which means that if a pulse is a 1, or mark, it stays there until the next pulse (which will keep it there if it's a mark too). The opposite of asynchronous is synchronous, where start and stop signals are not used. Instead the timing is continuous, and at the receiving end the timing information is recovered from the indivudal transitions. The idling condition, instead of a steady mark, must have some code character present to preserve the synchronization, and in ASCII a character called SYN, synchronous idle, is provided.

In RZ (Return-to-Zero), encoding timing is again extracted from the individual bits, and each bit contains both space-mark and mark-space transitions. The transition to mark occurs at the beginning of the bit, and for a 1 it stays marking for most of the bit-time, but for a 0 it goes quickly back to space and stays there for the rest of the interval. RZ has the disadvantage of requiring increased bandwidth as each info bit is accompanied by an explicit timing bit; that's one for the price of two.

NRZI (I for Inverted) does not assign a mark as 1 and a space as 0, but instead defines a change (inversion), either mark-space or space-mark, as 0, and a steady state as 1. "No data" can be represented as steady null characters (all zeroes) without loss of timing since a string of 0's is a string of transitions. But obviously a limit must be placed on the number of 1's allowed in succession. IBM's Synchronous Data Link Control (SDLC) system has a clever way of handling this, and though the system itself might not be too useful to the average ham, I think it is interesting enough to give a short description.

SDLC is used when a network consists of a number of "satellite" (not to be confused with the ones in the sky) synchronous machines, terminals, whatever, and one master device which is in charge of the network. The master can talk to any of the satellites, and the satellites can talk only to the master, even though they are all on a party line. If station A has a message for station B, the master can tell B to listen in, or can retransmit to B. It doesn't matter, though; this is up to the designer of the individual system and not of interest to SDLC.

SDLC uses NRZI encoding, and allows a maximum of five 1's in a row, except for one special character called a flag, which has six. Any time the information you wish to transmit has five 1's in a row, a zero is inserted and then removed at the other end. If you have 111110, you send 1111100, and the other end knows that this means 111110. The flag consists of 01111110 and is the only exception to this rule. Any transmission starts with a flag and ends with a flag. The idling condition between transmissions is a series of flags. Bit timing is recovered, as mentioned before, from the 0's, and character timing is started from the flags and maintained from the bit timing.

The first non-flag characters sent are address and control fields of fixed lengths. The control field is a code entirely independent of whatever codes are used in the text of the message. The address field designates the satellite involved: If the master is sending, it tells who is supposed to be paying attention; if the satellite is sending, it tells which one. Assuming that the master knows whether it is talking or listening, and given the constraint that satellites do not talk to each other, this is sufficient.

After these fixed-length fields, we have the information field, or the text. This may be in any code you like, and any length,

even empty. The only restriction is the five 1's rule, which is not really a restriction at all since it has no effect on the data conveyed. Next comes a parity (error-checking) field: fixed length, except it too is subject to the Rule. Last comes the flag, at which time the location of the parity field and the end of the info field are revealed by counting back a fixed number of bits from the flag.

Error-Detecting and Error-Correcting Codes

Parity bits as provided in ASCII and blocks of parity information as in SDLC provide a means for detecting errors, but it is possible to add more redundant information and not only detect errors, but correct most of them as well. No system can be totally foolproof, though, and there are diminishing returns from trying to make it so, as the efficiency of a system drops when you add the redundant bits needed to detect or correct errors. For amateur use, a message can just be repeated if received in damaged condition, but some systems have to get it right the first time. For them, insurance is available in the form of additional redundundancy. While a single parity bit can always catch a single error, it does not contain enough information to reliably detect multiple errors, and it cannot *correct* errors at all. But error-correcting codes, called Hamming codes(!) are fairly easy to implement (though at least at present not legal for hamming). Such a code will always detect a double error, and will always correct a single error. It is available in the following standard-sized packages:

Data bits	Hamming bits	Overall parity	Total bits
4	3	1	8
11	4	1	16
26	5	1	32
	etc.		

A Hamming code with overall parity contains 2^n bits; n is the number of Hamming bits, and there are 2^n-n-1 data bits. The longer the code, the more efficient it is (in data bits as % of total), though at the same time it is more susceptible to error.

With three Hamming bits there are a total of eight combinations. One of them is assigned to mean "no error", and the other seven correspond to a detected error in one of the seven bits (4 info + 3 Hamming bits). The code is arranged so that the numeric value of the combination is the actual location of the error – even if the error is in one of the Hamming bits itself. If a double error were received, however, this system by itself would correct the wrong error. Addition of the overall parity takes care of this; double errors still cannot be corrected, but at least they can reliably be detected. If overall parity comes out wrong and the error address is zero, then either there is a single error in the overall parity itself, or a double error, not correctable. The character is rejected. If overall parity is right and error address is not zero, a double error occurred. But if overall parity is wrong *and* the error address is not zero, there was a single error which can be corrected. Further discussion of error correcting codes is available elsewhere.[1,2]

Code Conversion

With all these codes flying around there is often a need to convert from one to another. One way which will work with any codes is to use a Read-Only Memory (ROM) which simply consists of a cross-reference table. If the ROM is large enough, several codes can be accommodated in it, and it is possible to make one device which will handle, for instance, ASCII, Baudot, Morse, Touch-Tone, and turning on the coffee pot on your way home.

Any binary code, whether weighted or not, can be easily converted to 1-of-n notation with chips like the 7442, a 1-of-10 decoder. This one takes a BCD input and produces a "low" on one of ten output lines, corresponding to the value of the input code. All other output lines remain high. If the input code has a value greater than 9 (defined as bogus in BCD), all output lines are high. Similar 1-of-10 chips are available for XS3 (7443) and XS3 Gray (7444). There are also 1-of-16 decoders, 1-of-8, and dual 1-of-4. The latter has two independent de-

[1] *Error Correcting Codes,* Peterson and Weldon, MIT Press, Cambridge, 1972.

[2] Applications Manuals from various IC manufacturers. My favorite is Fairchild.

coder circuits in one chip. All of these will work with any code; 1-of-10 requires special chips for special codes since, for instance, some of the combinations in XS3 Gray are wrong numbers in BCD, and vice versa. One of the main limitations in chip design is the number of output leads available, but a limitation in amateur design is the the parts available. You can use a 7442 as a 1-of-8, or two of them as 1-of-16, and so on. Different codes are handled by redefining the outputs.

In the same way, by arranging the inputs and outputs, a chip like the Fairchild 9318 Priority Encoder can be used to *en*code 1-of-8 or multiples thereof into any code. Only one input can be encoded at a time, and this chip produces output code corresponding to the highest-numbered active input if there are more than one. For some applications this is quite handy, while for others it is necessary to bypass this feature by ensuring that there is actually only one active input at a time. There must be thousands of ways to use this chip.

A code converter can be made from decoder and encoder chips very easily. This is most suited to the situation where either the input or the output code, or both, is oddball, which includes alphanumeric codes. ASCII/Baudot/Morse can be handled this way. Each input code requires a set of decoders (and only one may be active at a time) and each output code takes a set of encoders. All output codes are available simultaneously without switching. If there are several input codes, open-collector decoders should be used, such as the 7445 in place of the 7442, an otherwise identical chip.

Display Codes

What good is it if you can't read it, right? Fortunately there are a lot of ways to do that. For strictly numeric readout, there are the old faithful Nixies, which use a 1-of-10 decoder, and seven-bar, which takes a special chip. Seven-bar LEDs are making it big these days, and they can be driven directly from an IC, as can Numitrons (which I don't like, as they lose segments too easily) and others. Many chips have provisions for leading- and trailing-zero blanking, and some have latches built in for multiplexing, where one set of BCD (or hex) lines is connected to all decoders, and another input tells the individual chip when the data is intended for it. Data is "frozen" in each chip and periodically updated, and all digits of the display are on continuously. Chips without latches can be multiplexed too, but only one is on at a time. Scanning is rapid and continuous, and all the digits appear to be lit simultaneously. With a large number of digits, since brightness is proportional to average current, and each digit is lit only a small portion of the time, peak current may be rather high.

Another display system, variously called matrix, scoreboard, etc., has the characters formed by lighting a pattern of dots, and this is suited to just about any character, not just numerals. If only upper case letters are to be displayed, 5 x 7 is a popular choice, but with upper and lower case, legibility suffers and a denser matrix is used, 7 x 9, 9 x 12, etc. This system can be used both with LED matrices and TV screens. Instead of a relatively simple decoder chip, a ROM is used, and called a character generator. Inputs for the TV version (usable with LED also) are the code for the character and the address (location within the matrix in binary code) of the dot which is to be on or off. There is only one output line; it is the on/off signal going direct to the CRT gun. Other circuits such as random-access memories (RAM) or shift registers, keep track of what characters are in what places and provide the proper ASCII (e.g.) code to the generator at the proper time. The column and row inputs to the ROM and the RAM are provided by counters which run from a master clock (oscillator).

LED single line readouts are usually scanned a column at a time, and the character generator will have 7 outputs for a 5 x 7 display. Inputs are just the code and the column. This allows for a seven-fold increase in brightness, as the dots in a column do not have to share the time among themselves. In the TV system, brightness is not a problem, and only one dot can be scanned at a time anyway.

It is possible to get more well-defined characters in a TV system; 64 x 64 would only take six more bits (three for the column and three for the row) for the inputs

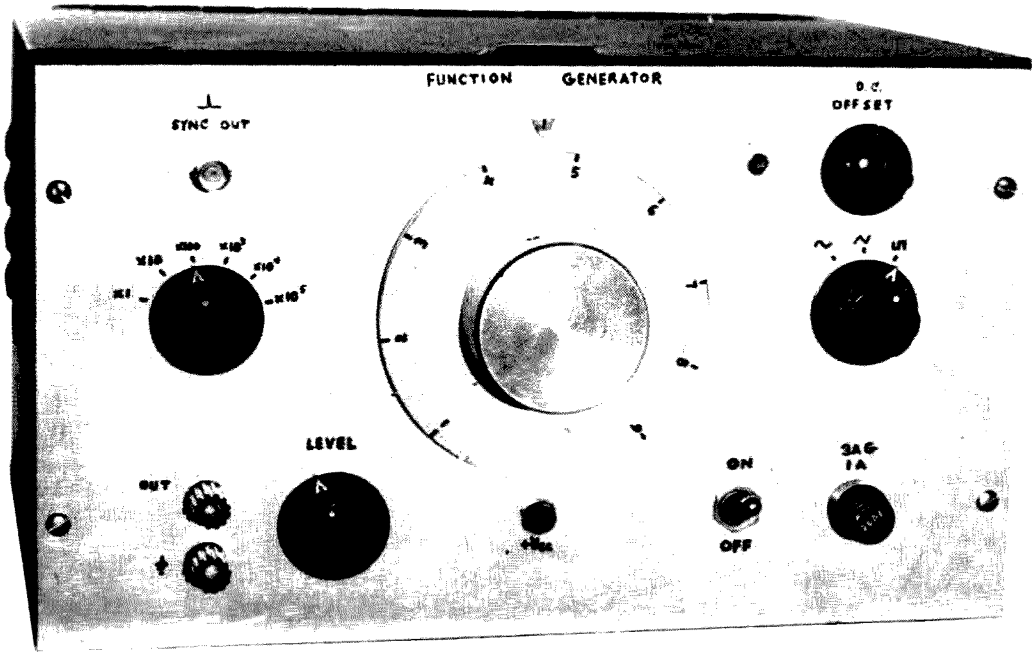
to the ROM, and no more outputs. If you wish to display Chinese this would probably do it well. You would probably run out of room in the ROM, but you can split it right down the middle and use two or four ROMs. Each split turns one input bit into a chip select function.

There are other ways to generate characters on a TV screen, such as making the beam follow the curvature of the letter. This is needed for such things as typesetting, but is unnecessarily complex for most applications, and I will not go into it here.

Other Aspects of Codes

I have purposely left out BCD to binary and back again, since this is a big enough subject for another separate article. Some basic arithmetic can be covered along with it. I can't think of anything else to write about codes, but I think I'll take all these ideas and some others I have and whip up a complete amateur station completely run with a keyboard and a TV set. It may take a while, but there will certainly be a lot to write about when it's done.

... K8BFH/1



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Build this Amazing Function Generator

The increasing popularity of a relatively new piece of test equipment (the function generator) has spurred at least two IC manufacturers to design special monolithic chips for this purpose. The Intersil 8038 and the Exar XR2206 are examples of such specially committed ICs, and several technical articles using these ICs as function generators have appeared in the recent literature.[1,2] These new ICs offer great simplicity in function generator construction, but offer the user very little "feel" for what is actually going on in the process of waveform generation. Since I find that the building of a piece of test gear is also a learning process, circuit flexibility and stage-by-stage analysis are important. For this reason, an older design for a function generator from a Motorola application note (AN510A) was the starting point.[3]

The Motorola application note AN510A by Bob Botos is actually the second edition of this publication, in which several printing errors in the earlier AN510 were corrected. So we can assume that the designs therein are at least five years old – pretty ancient in the fast-moving technology of the semiconductor era. However, Mr. Botos' design techniques are really timeless, and can be

[1] Megirian, R., "Integrated Circuit Function Generator", Ham Radio, Jan. 74, p. 22.

[2] Grebene, A., "Generate Waveforms with a Single IC", Electronic Design, Sept. 13, 1974, p. 132.

[3] Botos, R., "A Low Cost, Solid State Function Generator", Motorola Application Note AN510A, 1971.

brought up to date by substitution of newer, better components as they become available. The original AN510A output amplifier section, for instance, is a real "klooge" by today's standards, and so it was replaced by a simpler all-IC substitute. The original power supply used two dual-winding power transformers, four integrated bridge rectifiers, and four power IC regulators. This rather elaborate supply was replaced with one inexpensive transformer, one integrated bridge rectifier, and two of the newer Raytheon ± regulator ICs. A feature in the new function generator is dc offset, a simple addition that is really worthwhile.

The circuit of the function generator is shown in Fig. 1; note that four ICs as well as a number of discrete devices are used in the waveforming circuitry. In addition, two more *power* ICs are used in the power supply, shown in Fig. 2. A block diagram of the waveforming circuitry is shown in Fig. 3.

The integrator is composed of U1 and Q1, an op amp and an emitter-follower to lower the op amp output impedance.

The comparator is composed of U2, Q2, Q3, Q4, Q5, Q6, Q7, D8 and D9. U2 is an Emitter-Coupled Logic IC capable of extremely fast switching. Associated with, but not actually part of, the comparator are D10, D11 and D12 which serve as voltage regulators to provide U2 with +1.4 volts and -3.9 volts. It is worth noting that Q4, Q5 and Q6 were originally designated as Motorola MPS-L08 types in AN510A, but since this transistor type is now obsolete, appropriate substitutions have been made.

The "reference-switch" is made up of D1, D2, D3 and D4. Note that D3 and D4 are dual diodes. Also note that RB in Fig. 3 is either R8 plus R10 or R9 plus R11, depending on the state of the reference switch.

The "sync-amplifier" is a simple differentiator, rectifier and emitter-follower. The square wave from the comparator is differentiated by C13 and R30. D7 allows only the positive-going spike to be passed to the base of Q8. This positive spike is then available at the emitter of Q8 for a sync pulse.

The "sine wave shaper" consists of D5, D6, Q9 and Q10. D5 and D6 act as "soft" clippers on the triangle wave, and produce a near approximation to a sine wave. Q9 and Q10 simply act as emitter-followers after shaping — one NPN and one PNP, so that their emitter-base voltage drops cancel each other.

Since it was necessary to attenuate the triangle wave (with the voltage divider R33-R34) to make it compatible with the shaping diodes D5 and D6, the resulting sine

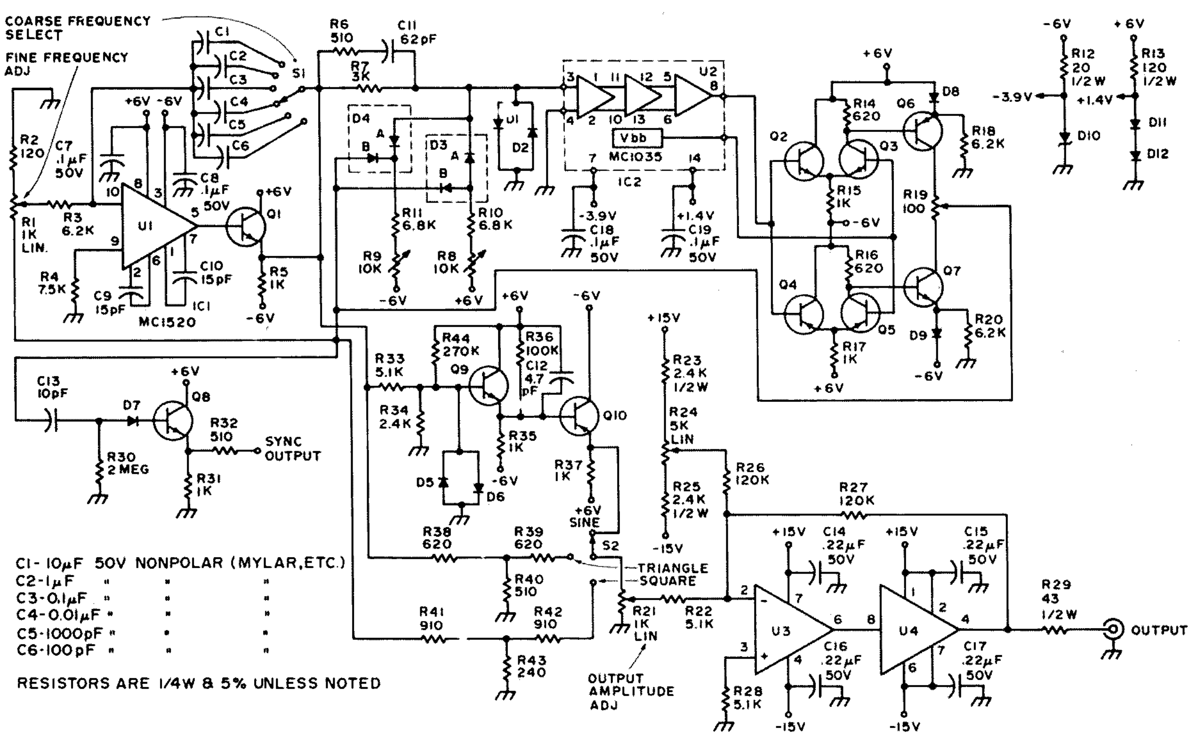


Fig. 1. Function generator, waveform circuits.

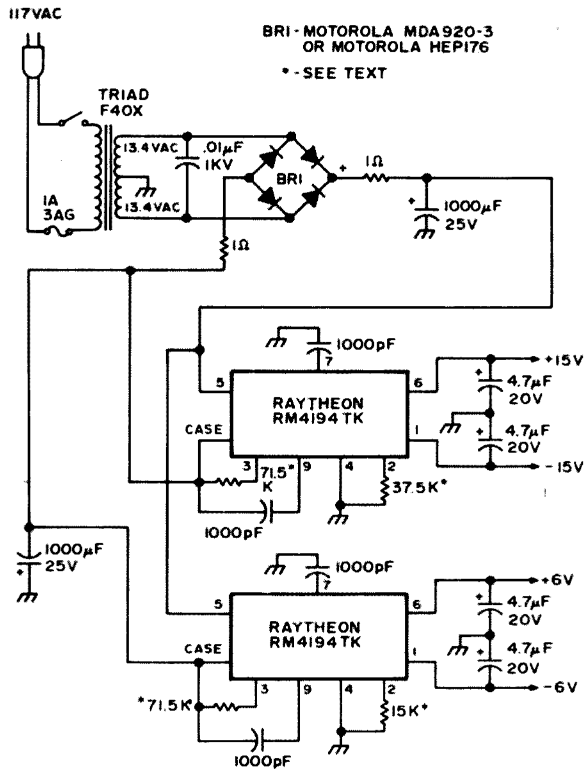


Fig. 2. Regulated power supply for function generator.

wave is smaller in amplitude than the triangular wave or square wave. To equalize the output levels of the three waveforms, simple "T" attenuators are placed in the triangle and square wave lines. These consist of R38, R39, R40 and R41, R42, R43 respectively.

Finally, the "output amplifier" consists of U3 and U4, a high slew-rate op amp and buffer amplifier. Note that the buffer is inside the closed loop of the amplifier. By adding in variable dc at the inverting input of U3 via a 120k resistor, a "dc offset" adjustment is easily obtained. This "dc offset" enables one to offset the three types of waveforms for testing of circuits which will accept only unipolar signals — such as logic circuits.

The power supply utilizes a Triad F40X (26.8 Vct 1A) transformer which combines low price, small relative size and high current capability. An integrated bridge and two Raytheon RC4194TK integrated circuits in the circuit of Fig. 2 provide ±15 volts and ±6 volts for the waveforming circuitry. The RC4194TKs are heat-sink mounted to the chassis with T066 mica wafers for heat transfer and electrical insulation. The F40X transformer is mounted *under* the chassis to keep it electrostatically shielded from the top-mounted waveforming circuits. The two 1000 uF filter capacitors are also mounted under the chassis because of the relatively large ac line ripple on them.

The function generator is built into an old 7" x 8" x 10" steel equipment cabinet, to which an aluminum panel has been fitted. The aluminum panel was originally an old black-crackle finished relay rack panel which was stripped of paint and cut down to size. The left over portion of this same panel was made into the frequency dial, by rough sawing and turning down the outer diameter on a lathe. The large aluminum "spinner" knob for the center of the frequency dial was also turned from a scrap of bar stock on the lathe. The basic planetary drive for this

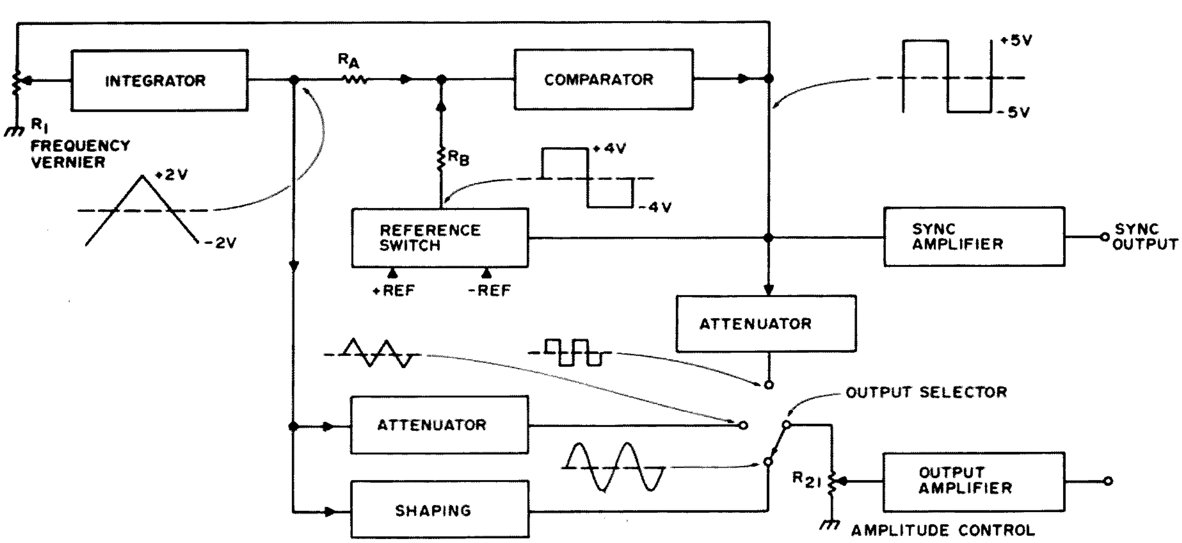


Fig. 3. Block diagram of function generator.

control was a National Velvet Vernier salvaged from a surplus BC375 or BC191 tuning unit. Those with fancier dial systems available or without access to a lathe and the above surplus drive units can use other methods – even a plain large knob. One will note that one of the timing capacitors in the circuit of Fig. 1 is a 10 uF non-polar type. Because the author had the room in the cabinet, an old 10 uF 600 V transmitting capacitor was used. It was mounted on a homemade insulating mount, as otherwise stray capacity to the capacitor case was objectionable in this circuit.

The relatively small amount of circuitry of the power supply is mounted under the chassis. The power supply should be the first section checked out, preferably before connecting it to the waveforming circuits. Note that each RC4194TK has a 71.5k resistor from "case" to #3; this is the nominal value suggested by Raytheon. Sorting through one's 68k and 75k resistors will give a few values close to 71.5k – use these. The 37.5k and 15k resistors from pin #2 of the RC4194TKs will then be target values to give ±15 volts and ±6 volts respectively. Some juggling of these target resistance values may be required to give exactly the voltages desired.

Assuming that the power supply has been checked out, as above, and puts out ±15 and ±6 volts, the waveforming circuitry can be connected to it. The pots R1, R8, R9 and R19 should all be set at mid range, and the pot R21 set at minimum. The dc offset pot should also be set at mid range.

With the scope on the wiper arm of R19, adjust this pot until the waveform looks like a square wave (i.e., the positive portion is as long as the negative portion). Then put the scope on the emitter of Q1, and adjust R8 and R9 until the triangular wave observed there has a ±2 volt value. R19 should be "retweaked" as above and then R8 and R9 again. The scope can now be shifted to the output, and "dc offset," level, frequency and sine-shaping checked.

This function generator has been a "silk purse from sow's ear" project for me, a useful piece of test equipment built up from odds and ends. While the semiconductor costs can be as high as $35.00, appropriate substitutions can trim this figure somewhat. To this end most of the diode (D) and transistor (Q) designations have several acceptable numbers given in the parts list.

Parts List

D1, 2 – Silicon signal diodes: Motorola MSD6102, 1N4454, or 1N914
D3 – Dual Si. signal diode: Motorola MSD6150, or two 1N4454, 1N914
D4 – Dual Si. signal diode: Motorola MSD6100, or two 1N4454, 1N914
D5-9 – Silicon signal diodes: Motorola MSD6102, 1N4454, or 1N914
Q1, Q8, Q9 – NPN Xstr: Motorola 2N4124 or HEP53, or 2N3643, or HEP-S0014
Q2, Q3, Q7 – NPN Sw. Xstr: Motorola 2N709 or HEP50, or 2N3646, or HEP-S0011
Q4, Q5, Q6 – PNP Sw. Xstr: Motorola 2N4260 or HEP720, or 2N3640, or HEP-S0019
Q10 – PNP Xstr: Motorola 2N4126 or HEP57, or 2N3644, or HEP-S0019
U1 – Motorola MC1420G or MC1520G
U2 – Motorola MC1035P or MC1235L
U3 – National Semiconductor LM318H, LM218H, or LM118H
U4 – National Semiconductor LH0002CH or LH0002H
D10 – Motorola 1N4730A or HEP-Z0403
D11, 12 – Motorola 1N4001 or HEP-R0050

. . . W6GXN

FCC NEWS

Before the
Federal Communications
Commission
Washington, D.C. 20554

In the Matter of

Amendment of Part 97 of
the Commission's Rules
to permit linking of
amateur repeater stations

Docket No. 20073
RM-2349

Report and Order
(Proceeding Terminated)

Adopted: May 28, 1975
Released: June 5, 1975
By the Commission: Commissioners Hooks and Washburn absent.

1. On June 5, 1974, the Commission adopted a Notice of Proposed Rule Making in the above-entitled matter which was published in the Federal Register on June 13, 1974 (39 FR 20704). Proposals in this proceeding contemplated amendment of Part 97 of the Commission's Rules to delete the proscription against interconnecting more than two repeater stations in the Amateur Radio Service, i.e., the tandem operation of more than two repeaters. Comments as to these proposals were submitted by the parties listed in Appendix A. Each of these comments has been carefully considered as indicated in the following discussion.

2. By way of background, in 1972, the Commission formalized specific rule provisions for the operation and technical development of amateur radio stations which can receive and automatically retransmit the signals of other amateur stations. (See the Report and Order in Docket No. 18803, 37 FCC 2nd 225, 1972.) Prior to these rule changes, repeater stations had been authorized in the Amateur Radio Service under limited general rules that related primarily to any remotely controlled station. In that proceeding the Commission expressed the opinion that terrestrial repeater stations should be utilized only for intra-community radiocommunication. This and a desire to conserve spectrum led the Commission to adopt rules which would accommodate the majority of situations. In March, 1974, the American Radio Relay League, Incorporated, submitted a Petition for Rule Making, RM-2349, to delete the portion of the rules which prohibits the interconnection of more than two repeater stations.

3. All comments supported the proposal as being timely and in general conformance with today's practical requirements for amateur repeater operations. Some respondents, however, confused the proposal to permit unrestricted tandem operation of repeater stations with a proposal to eliminate the prohibition of crossband operation of such interconnected stations. The subject of crossband operation of amateur repeaters is being considered in a separate proceeding, FCC Docket No. 20113. This proceeding deals only with the tandem operation of repeater stations which are being operated in the same frequency band.

4. In line with our proposal, we are deleting the prohibition of tandem operation of more than two repeater stations. Certain requirements will, however, have to be observed by the licensees/trustees of all such stations which are interconnected. Since at least two different stations are involved in a system of interconnected repeaters, a system network diagram, showing all related stations in the system, must be submitted in accordance with Section 97.47(e) of the Commission's Rules by the licensee(s) of each participating station. This diagram should include any auxiliary link stations which may be used to effect the interconnection. It is required even though the interconnection may occur only occasionally or on a part-time basis and is brought about by the Commission's need to be aware of which stations are involved in such a system.

5. Licensees/trustees and control operators of all tandem operated repeater and associated stations should remain aware that the interconnection of their station with any other station does not relieve them of the responsibility for proper operation of their station. If any of the participating stations are licensed to be operated by remote control, the submission of a revised system network diagram does not, in itself, alter the list of authorized control points for each remotely controlled station. Where the authorized control points of one station in a system of interconnected stations are also intended to serve as primary control points for other stations in the system, the station licenses of those other stations must be appropriately modified.

6. The revised rules will afford amateurs considerably increased flexibility in the operation of repeater systems. Implementation of tandem operation of repeater stations will require no special applications. However, as previously discussed, revised system network diagrams must be submitted to the Commision for each participating station. These diagrams should be sent directly to the Federal Communications Commission, Gettysburg, Pa., 17325, and should be clearly marked as to the name(s) of the licensee(s) and the callsigns of the participating stations.

7. In consideration of the foregoing, the Commission finds that amendment of the rules to permit unrestricted interconnection of amateur repeater stations is in the public interest, convenience, and necessity.

8. Accordingly, pursuant to authority contained in sections 4(i) and 303(r) of the Communications Act of 1934, as amended, IT IS ORDERED That, effective July 11, 1975, Part 97 of the Commission's Rules IS AMENDED as set forth below:

§97.89 [Amended]

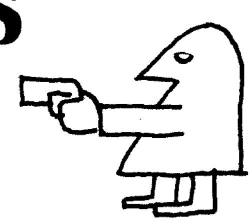
In §97.89, paragraph (c) is deleted and designated "[Reserved]".

9. IT IS FURTHER ORDERED That this proceeding IS TERMINATED.

Federal Communications Commission
Vincent J. Mullins
Secretary

CONTESTS

Editor:
Robert Baker WA1SCX
34 White Pine Drive
Littleton MA 01460



CALGARY CENTENNIAL
CALGARY-to-MOBILE CONTEST
Starts: 1700 GMT July 26
Ends: 1700 GMT August 7

The contest is to promote hospitality and interest in the Calgary Centennial Convention. All contacts must be between CY stations (fixed or mobile) and convention guests who are not Calgary residents and who are operating mobile on their way to the convention.

EXCHANGE:
Report, name, location of mobile. One contact per band per mode per day.

SCORING:
Score 1 point between CY and mobile who is within city limits of Calgary, 2 points between CY and mobile outside city but within Alberta, 3 points between CY and Sask, B.C., or Mont., 4 points between CY and any other QTH.

FREQUENCIES:
Mobiles look for CY stations afternoons and evenings ± 20 kHz of 3770. When in range, check 34-94, 28-88, and 146.46-147.00.

LOGS:
Logs must be deposited at the Calgary Centennial Convention registration desk no later than 2359 GMT August 2. Show date and time in GMT, mode, band, reports, first names, and location of mobile.

ILLINOIS QSO PARTY
Starts: 1800 GMT Saturday, August 2
Ends: 2300 GMT Sunday, August 3

Rest period from 0500 to 1200 GMT Sunday, August 3. The 13th Annual Illinois QSO Party is sponsored by the Radio Amateur Megacycle Society, Inc. (RAMS). Same station may be worked with each mode (CW and phone) on each band. No repeater contacts allowed. Contacts with K9CJU/9 aboard U.S.S. Silversides submarine will count as 5 regular contacts for scoring. The word SUBMARINE will be added to the exchange sent by K9CJU/9. Send an SASE for special QSLs that will be available.

EXCHANGE:
Illinois stations give RS(T) and county. Others, give RS(T) and state, province, or country.

SCORING:
Illinois stations add the number of Illinois counties, states, Canadian provinces, and ARRL countries. Multiply total by the number of QSOs for score. Illinois mobiles, add 200 points to score for each county operated from (except home county) with 10 or more contacts made. Other stations, multiply total number of contacts by county multiplier. For Non-IL only, each group of eight contacts with the same county gives one bonus multiplier. Sum of counties worked plus bonus multipliers equals county multiplier.

FREQUENCIES:
60 kHz from low end of CW bands. 25 kHz from high end of phone bands, and 21375 & 28675. 25 kHz from low end of Novice bands on the half hour.

AWARDS:
For Illinois stations, certificates to top three scorers in Single-op, Multi-op, Portable (non-home county), Mobile, and Novice categories. Others, awards go to scorers in Fixed, Mobile or Novice groups in each state, Canadian province or county from which 2 entries are received. Top scorer in any club mentioned in 3 entries also rates an award. Decisions of contest committee are final.

LOGS:
Legible logs must be submitted. A separate summary sheet must show name, address, call and category of operation. Summary should also show number of contacts, list of multipliers, and claimed score. Entries should be postmarked no later than Sept. 15, 1975. Include a business size SASE and mail to: RAMS – K9CJU, 3620 N. Oleander Avenue, Chicago IL 60634.

NEW JERSEY QSO PARTY
Two Periods (GMT)

2000 Saturday, August 16 to 0700 Sunday, August 17
1300 Sunday, August 17 to 0200 Monday, August 18

The 16th Annual N.J. QSO Party is sponsored by The Englewood Amateur Radio Assoc., Inc. Phone and CW are considered the same contest. A station may be contacted once on each band; phone and CW are considered separate bands. N.J. stations are requested to identify themselves by signing "DE NJ" or "NJ CALLING" and N.J. stations may work other N.J. stations.

EXCHANGE:
QSO Nr., RST and QTH – County for N.J., ARRL Section or country for others.

SCORING:
N.J. Stations – W, K, VE, VO QSOs count 1 point while DX QSOs count 3 points. Final score is sum of QSO points times number of ARRL Sections (including NNJ & SNJ). KP4, KH6, KL7, KZ5, etc., count as both 3 point DX QSOs and as section multipliers. Others – Multiply number of completed N.J. QSOs by number of N.J. counties worked (maximum of 21).

FREQUENCIES:
1810, 3535, 3735, 3905, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28600, 50-50.5, 144-146. Suggest phone activity on even hours, 15 meters on odd hours between 1500 & 2100 GMT, and 160 meters at 0500 GMT.

AWARDS:
Certificates will be awarded to first place stations in each N.J. county, ARRL Section, and country. Second place certificates will be awarded when 4 or more logs are received. Novice and Technician certificates will also be awarded.

LOGS:
Logs must show GMT date and time, band and emission in addition to the required exchange information. First contact for each claimed multiplier must be indicated and numbered. A check list of QSOs and multipliers should be included. Multi-operator stations should be noted and calls of all active operators listed. Logs and comments should be received not later than Sept. 13, 1975 and should be sent to: Englewood Amateur Radio Assoc., Inc., 303 Tenafly Road, Englewood, NJ 07631. Include a size #10 SASE for results.

ALL ASIAN DX CONTEST – CW
Starts: 1000 GMT Saturday, August 23
Ends: 1600 GMT Sunday, August 24

Non-Asian stations work Asian stations, KA contacts do not count.

CLASSES:
Single operator, single and all band. Multi-operator, single transmitter, all

band only. Club stations are considered Multi-operator stations.

EXCHANGE:

RST plus age of operator, YLs send "ØØ" for age. Each operator of Multi-operator stations will give his age while operating.

SCORING:

One point per QSO. Asians, use number of non-Asian countries worked as multiplier. Non-Asian stations, use number of prefixes of Asian stations worked as multiplier.

FINAL SCORE:

The total QSO points from each band times the sum of the multiplier on each band equals the final score.

AWARDS:

Certificates awarded to top single operator, all band and each single band, in each country and USA call area; up to the fifth rank where returns justify. In addition to the certificates, medals will be awarded to the continental all band leaders and multi-operator continental leaders.

LOGS:

Use a separate log for each band, show all times in GMT, fill in country or prefix column first time worked. A summary sheet is required, showing scoring and other information. Include a signed declaration that all rules and regulations have been observed. Logs must be received no later than Nov 30, 1975. Logs should be sent to: J.A.R.L. Contest Commitee, P.O. Box 377, Tokyo Central, JAPAN. Include an IRC and SAE for results.

FOUR LAND QSO PARTY

Starts: 1800 GMT Saturday, September 6
Ends: 0200 GMT Monday, September 8

The Sixth Annual Four Land QSO Party is sponsored by the Fourth Call District Amateur Radio Association of the I.A.R.S. The same station may be worked again on each band and/or mode fixed, and repeated again if operated portable or mobile, and from each different county.

EXCHANGE:

RS(T), county and state for 4th call district; state, province or country for others.

SCORING:

Fourth call district stations score 1 point for W/VE QSOs, 3 points for DX contacts (include KH6 and KL7); final score is total points times states and provinces (states and provinces counted only once). All others score 2 points per QSO and multiply by the number of fourth district states and counties. Count each state and county only once.

FREQUENCIES:

CW: 3575, 7060, 14070, 21090, 28090 plus or minus 10 kHz. Phone: 3940, 7260, 14340, 21360, 28600. Novices: 3710, 7110, 21110, 28110 plus or minus 10 kHz.

AWARDS:

Certificates to top scorers in each state, VE province, and country. Second and third place awards when scores warrant. HHTA (High Honor Trophy Award) certificate to high scorer in four-land, high W/K, out of four-land, VE and DX country. Also, county awards to fourth call district states and special awards to Novices, SWLers, and B/H (blind/handicapped).

LOGS:

Contestants must mail logs with score within thirty (30) days of the end of party to 4th District A.R.A., Att: Bob Knapp W4OMW, 105 Dupont Circle, Greenville NC 27834. Include an SASE for contest results.

WASHINGTON STATE QSO PARTY

Starts: 2000 GMT Saturday, September 13
Ends: 0200 GMT Monday, September 15

The Tenth annual Washington State QSO Party is sponsored by the Boeing Employees' Amateur Radio Society (BEARS), and all amateurs are invited to participate. All bands and modes may be used. Stations may be worked once each band and each mode for contact points and more than once each band/mode if they are additional multipliers.

EXCHANGE:

Washington stations send QSO number, RS(T), and county. All others send QSO number, RS(T), and state, province or country.

FREQUENCIES:

CW: 3560, 7060, 14060, 21060, 28160. Phone: 3835, 7260, 14280, 21350, 28660. Novice: 3735, 7125, 21150, 28160.

SCORING:

Washington stations score one point for each contact (including contacts with other Washington stations). All others score two points for each contact with a Washington station. Washington stations multiply total contact points by the total of different states, Canadian provinces and other foreign countries worked. All others multiply total contact points by the total of different Washington counties worked (39 maximum). There will be an extra multiplier of one for each group of eight contacts with the same Washington county.

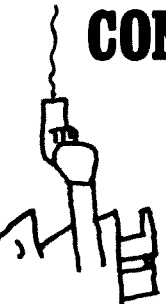
AWARDS:

Certificates will be awarded to the highest scoring stations (both single and multi-operator) in each state, Canadian province, foreign country and Washington county. Additional certificates may be issued at the direction of the Contest Committee. Worked Five BEARS Awards are also available to anyone working five club members before, during or after the QSO Party (unless previously issued). All QSO Party entries will be screened by the Contest Committee for possible Worked Five BEARS Awards. Worked Three BEAR Cubs Award is available for working three Novice members.

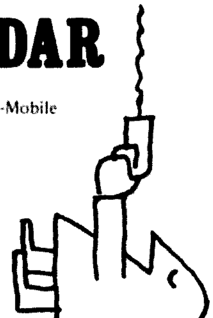
LOGS:

Logs must show dates and times in GMT, stations worked, exchanges sent and received, bands and modes used and scores claimed. Include check sheet for entries with more than 100 QSOs. Each entry must include a signed statement that the decision of the Contest Committee will be accepted as final. No logs can be returned. Results of the QSO Party will be mailed to all entrants. SASE is NOT required! Log sheets and scores must be postmarked no later than October 13, 1975 and sent to: Boeing Employees' Amateur Radio Society, c/o Contest Committee, Willis D. Propst K7RSB, 18415 38th Avenue S., Seattle WA 98188.

CONTEST CALENDAR



July 26 - Aug 7	Calgary Centennial, Calgary-to-Mobile
Aug 2 - 3	WAE DX Contest - CW
Aug 2 - 3	YO Contest
Aug 2 - 3	Illinois QSO Party
Aug 9 - 10	European DX Contest - CW
Aug 16 - 18	New Jersey QSO Party
Aug 23 - 24	All Asian Contest - CW
Sept 6 - 7	ARRL VHF QSO Party
Sept 6 - 8	Four Land QSO Party
Sept 13 - 14	European DX Contest - Phone
Sept 13 - 15	Washington State QSO Party
Sept 27 - 29	Delta QSO Party



LETTERS

from page 11

After you experiment with a Flipper and tape system, you may want to try some of those "multi-screen" effects that you see in movies. You can add more Flippers and pairs of projectors (if you don't feel like buying them, some college communications departments are buying whole systems), but you run into the problem of how to put that many tones on tape. Touchtone signalling, like you do for autopatch, might work. However, a commercial synchronizer that costs (gasp) $1200 uses a different system. It develops a pulse train very rapidly, and frequency-shifts an audio tone to put the commands on tape. The big improvement over touch-tone is the fact that this system controls nine channels, and can operate them all *simultaneously*.

If any of you gents or ladies have had experience building anything complicated like that, would you write me? If nothing else, this might develop an interesting method of repeater control.

I want to thank you for three months of interesting reading. I have no ham license, but I do have a commercial First Phone, and I am fascinated by the great variety of articles you print. The series exposing Ma Bell is manna from heaven, and your other articles are more candid than anything I have read since before I was born. (I was an early learner.)

A relative of mine is a rabid CBer, and has stuck one of those cursed linears on his set. I have been trying to talk him into becoming a ham, but he claims that Morse code and electronics are too hard, and besides, he says all hams are conceited cottonpickers. Can you tell me what a cottonpicker is? I hear this word from CBers, on and off the air, and it appears to have a mystic significance, like "Om mane padme om" and "Hare Krishna". Can anybody translate, please?

Thomas E. Reed
Chief Engineer, KBIL Radio
Saint Louis University
1220 Midland Blvd.
University City MO 63130

The Michigan Radio Doctor and friend supply one cotton pickin' definition on page 93. – Ed.

BEST

I just received my June issue of 73 and after going over it cover to cover and back again, I have one comment to make: It's the best damn ham mag I've ever read! I've subscribed to the other mags (CQ and QST) and I must admit that they are not even a close 2nd to 73.

I think I got the best enjoyment out of your editorials and letters from your readers. I would like to see more articles for the Novice and beginning ham like QST once had a long time ago.

Not being an engineer, just a ham that likes QRP and home brewing all of my gear, I like to see articles that the ordinary ham who doesn't have an EE or a complete machine shop at his disposal can duplicate. I run anywhere from 500 mW to 35 Watts in power on all of the Novice bands, and have much enjoyment in talking to these hams because they usually don't have the hello-goodbye QSO that is mostly the rule on the bands today.

Keep up the good work, Wayne, and you can bet that when my one year subscription to 73 is up, I'll renew for many years.

Tom Cullen Jr. K1WXK/W1NXZ
2 Westview Dr
Wallingford CT 06492

STOP THIS CHEATING

I read ur "In Pursuit of the Perfect SSTV Picture" on p. 73 of May 75 "73 Magazine" with great interest. I started SSTV in Dec. 1972 with a gift cassette recorder "Standard SR-T115" which my daughter had bought me as a present at KV4AA's shop on St. Thomas V.I. when she was a nurse on the next Island of St. John – she has recently moved to Hugo, Okl. I soon found that the absence of a "turns counter" made finding a spot again on a cassette in a hurry an impossibility. Therefore in Jan. 1973 I bought the SONY TC 129 stereo deck, the later model of the one recommended by ROBOT, and it is excellent.

When you review the lengths of cassettes u do not start on a real short length; I use 3 and 6 minute Endless Cassettes, the EC-3 & EC-6 (there is also a one minute one) made by TDK Electronics Co. Ltd. of/in Japan, and find them excellent for pre-recorded information e.g. 3m for 2xCQs, 6 min. for Name, QTH, station equipment, etc., etc., another 3 minute for QRZ de G3WW, ok from G3WW, hw copy? pse K., etc., etc.

Ur SSTV column and articles are of great interest to the SSTV gang in Great Britain & are regularly discussed each Sunday morning about 0730 gmt on the 80m SSTV Net on 3735 kHz; "SSTV Video Analysis" by WB8DQT in Jan. 75 issue has been applied to two home built monitors (SSTV) with the results forecast, while it saved me (?) $99.0 in nt having to buy the ROBOT mod. kit to up-date my 70 Monitor, already modded to 70A, to 70B. I already have the Fast Scan Montr Model 61, so by adding his (WB8DQT's) Video analyzer with single sided discriminator to my Robot Monitor I achieved a better-than-70B result as with the 61 I cld set up camera 80A on the F/S Mon while receiving SSTV on the 70A. BUT IT IS NECESSARY TO FULLY FLOAT THE EXTRA SINGLE-SIDED DISCRIMINATOR WITH A three pole (nt double pole) double throw switch when nt in use, as *if the input is left connected to* the Robot Limiter Output the circuit will *"ring" and distort the video – try it and see.*

G3GGJ has made up for me both the WØLMD Keybrd (CQ-Sept 74) with PC Board by W8OZA, to give me the very first one in Europe in Apl. 75, and the SSB/SSTV Bandpass filter by DJ6HP (CQ-DL-Aug. 1974); there are now two SEEC Keyboards in HB9 land and one in OD5.

I used ur Navassa battery tape recording method for /M SSTV reception (see last Fall's ROBOT Newsletter) but with an outboard tuning indicator between FT.101 & recorder; did u know that if an SSTV signal is recorded "off tune" it can be restored to full intelligibility by transmitting the tape thru a dummy load & receiving that transmission on a sep. rx which in turn can be tuned to give an intelligible "picture" of what is on the tape?? Finally, this year's Worldwide SSTV was AGAIN a FARCE; the rules should be the SAME FOR EVERYONE; nt the Ws praying in aide the FCC reqmnt for voice station identification at start & end of each qso while the rest of the world must nt utter a word, *and then expanding this to* "This is WB4 . . . calling CQ SSTV contest" – "Hallo, W2 . . ., did u get ur report ok?" "Yes WB4 . . . I got my report ok at 5.7 but did you give me 010 or 020 in video?" "No, I gave u 020 & thanks for my 5.9" – ALL THIS SORT OF EXCHANGE BY

Continued on page 132

LETTERS

from page 130

VOICE. Let evryone use voice for station identification worldwide AND FOR NO OTHER PURPOSE *and stop this cheating.* Is it not now marvelous to think how ur review of Voice Operated Switch (for a Mobile transmitter) in CQ. August 1958 (when I telephoned u about it in NY from Princeton NJ) has become the worldwide VOX system?

Richard Thurlow G3WW
2 Church Str.
Wimblington, March
Cambs, England

STAY THE SAME

I'm enclosing a credit memo you issued to me, apparently when I paid for a subscription twice. Please apply the amount toward extending the subscription, advising me of the date the extended subscription will run out. (There aren't many magazines that I would consider subscribing to for such a length of time. Stay the same.)

Don Sawyer
Roswell NM

VOICE WITH CHARACTER

I would like to order several of your cassette tapes for learning the code and theory for friends of mine. However, before sending the Basic Code and 6 wpm tape, I would like to know if the letter characters are sent at a speed of approximately 14 to 15 words per minute with spacing between the characters to make the speed only 6 words per minute. I understand this is the new method (as I was taught that way), wherein you do not have time to count the dits and dahs yet you learn the characters at a fast sending speed so that when you increase your speed you merely close the gap between letters, etc. Also this does away with hearing slowly sent characters and when you increase the speed the dahs won't sound like dits.

I'm sure you know what I mean since you are in this business. I've heard various tapes and records by AMECO and Radio Shack and they are terrible. A friend of mine bought a Radio Shack tape for code – it is so noisy and bad (and the characters are also sent at slow speed) that when you hear these same characters sent at a high speed it doesn't sound the same. Please do not send these two tapes if they are not what I want. This is also why I have not sent money with this order, as I don't know if it is what I want for my friend. Otherwise I will make up my own tapes for him, but I'd rather save time and let him buy yours, if they are what he should have.

Also, on the basic tape, do you give the character in voice as you first learn the character or is it written on a sheet of paper? I think voice with the character as in a class is best.

Thank you kindly.

Mervin Behlen WA6SMG
Fresno CA

Yes, I have my voice on the basic tape telling about each character. And the letters are all sent at 13 wpm with spacing for 6 wpm so you only have to learn the code one time . . . by the sound. This is by far the fastest system of learning the code and, as far as I know, only *my tapes use this fantastic system – Wayne.*

TRAGIC

Having recently subscribed to Hotline, I am very pleased with it. This is really worth the price. If the price was twice as much it still would be a bargain!

Re your editorials: I agree that the new FCC proposals would definitely hurt amateur radio. I think the code test should be lowered to 5 wpm and left there for all classes. And I also agree that only two classes of licenses should be issued.

But as usual, the FCC will probably ram the new rules down our throats to the detriment of amateur radio. If this happens our numbers will decrease, not increase!

Which gets me down to the point that now interests me, because I sell CB and some ham equipment in a store which I recently put in business. When I first opened I thought that there would be some interest in amateur radio but so far I have experienced very little. Most CBers don't care a bit about getting their tickets. This to me is tragic. CB now is a bunch of lawbreakers who don't use call letters, swear on the air, run over power, give location of police cars to break the law, throw carriers, and just are plain ignorant! When I was on CB in the early and mid 1960's, call letters were used and people operated properly most of the time. To buy a CB rig and try to use it is an exercise in futility, as you will get blown off the air by people who just don't care. Too many people are on the few channels that there are.

A complaint I hear quite often and have noticed myself a bit is the lack of interest many amateurs take in getting new people interested in our hobby. There are too many people who don't want new members in our ranks. This is why some good people have gone bad with CB radio.

I sure hope things change for the better, because they have been getting worse since the ARRL incentive plan ten years ago.

I am really glad you understand the issues – the other magazines sure don't. I let my subscription to CQ lapse. It has gotten very poor, with few pages.

Well, I'd better go now. Thanks for taking the time to read my letter. Keep up the really good work, and fight for what you believe in.

Pete K. Hons
Portage PA

VISCIOUS CODERY

You may enter my name and call on your list of satisfied code tape users who, after mastering that mean, vicious piece of "Morse codery" put out by 73 Magazine under the guise of 14 wpm, passed his 13 wpm code test with ease. I might add that I failed it 5 times prior to using your tape for practice. I think anyone who wants to spend the time mastering this extremely tough tape should have no problem passing the test before an FCC examiner – even with the jitters that accompany the test. By the way, I now have my Advanced Class test passed and am waiting for my ticket.

Jim France WA8HHO
Massillon OH

ASTONISHED CLUB

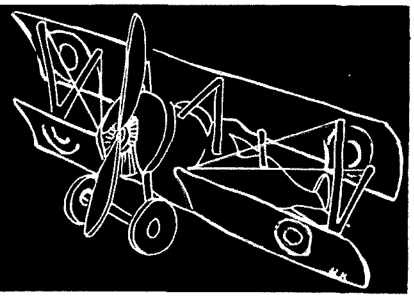
Acting on the advice of some smart ham, I ordered your Advanced Study Guide (after about nine months of *struggle* with several other books). Two months later I passed it (much to the astonishment of the rest of my ham club!). Many thanks.

Phil Litchfield WA1OFP
New Canaan CT

Continued on page 136

Autobiography of an Ancient Aviator

W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230



KELLY FIELD FLYING

The Kelly Field flight training was very interesting. We didn't just fly around aimlessly. Each day some aspect of our ground training was put to use in the air.

Visual reconnaissance missions (There were several of these to different towns): We were instructed to fly over a certain town or district, usually within a 50 mile radius, and make a sketch of the area indicating any features of military interest such as factories, railroads, highways, water towers, flying fields, etc.

Aerial Photography (Several to various locations): Same procedure as Visual Recon Missions except that we photographed strategic places. I even took a good shot of Art Caperton riding on the turtle back of another ship.

Puff target range: We dropped simulated bombs on the smoke bomb range and were marked according to our accuracy.

Artillery Regulage: This was more fun. It was done in cooperation with a Field Artillery unit at Camp Stanley (about 30 miles away). Our job was to fly over a target at a low altitude and direct the artillery fire (live ammo) to right, left, forward or backward of the target center. The radio equipment we had for communication with the artillery consisted of a transmitter with key and an antenna that trailed below the plane with a fish (weight) to hold it down and a reel in the rear cockpit to raise and lower it. One time I tried to climb too fast with the antenna out and the DH fell off into a turn of a spin. This wound the antenna around the tail of the ship. The rudder didn't work too well but the elevators were OK, so I got back to the field and landed with no trouble. I didn't get a very good mark on that mission.

Everyone enjoyed a wild orgy of flying calculated to draw flowers.

Aerial Gunnery: For this work we spent several days at Ellington Field (near Galveston). Small ponds, shadows, panels and birds were our targets. Live ammunition was used in the two Lewis machine guns which were mounted on a scarfmount over the rear cockpit. While we were at Ellington the rigid flying rules of Kelly Field were dispensed with. Everyone enjoyed a wild orgy of flying calculated to draw flowers. However, all eventually returned to Kelly more or less safely. Although the return weather was CAVU (clear and visibility unlimited) some got lost on the way and didn't straggle in to Kelly until the next day.

Cross Country Trips: The trip to Ellington and return was our first, about 235 miles each way. Our longest trip was to Post Field, Oklahoma, via Dallas, with return via Waco. An overnighter of about 720 miles if you flew in a straight line. There were several other shorter cross countries of up to 300 miles.

Formation Flying: Only about ten hours of this flying was done by our observation group. Five ships to a Vee formation. A lot of this practice was in formation take-offs, lands and turns. The object was to keep away from the other fellow and not let him put his wing in your lap.

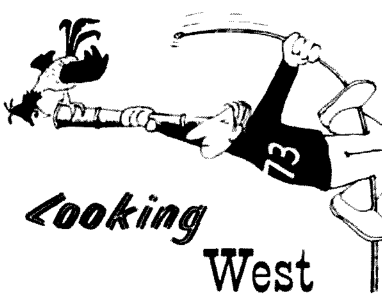
As we approached Love Field, Dallas, on our way to Post Field, I was driving the ship. As I came in to land I saw giraffes, zebras, camels, elephants and other animals grazing on the field. I decided to circle the field again while I reviewed what I had eaten in the last 24 hours and asked Munson in the rear cockpit if what I was seeing was really there. Affirmative. Then I managed to land without hitting any of the beasts. When I climbed out of the ship an over-friendly black bear came up to be petted. This one exuded that rare combination of B.O. and halitosis. I have a snapshot of this delightful experience.

When Munson and I were coming in to land at Kelly from our cross-country trip to Post Field, we had a slight mishap that could easily have been much worse. It was almost dark and what we didn't know was that, during the two days we were away, they had put up some goal posts for a football field, one of which was right on the hangar line. Munson was piloting and made his landing approach in the usual manner. He landed and taxied up to our hangar. Then we found out that on our approach we had hit one of the goal posts with our wing and broken the post off. The fortunate part of the mishap was that contact with the goal post was at the root of the right wing (next to the fuselage). If it had been farther out on the wing we would most probably have been in serious trouble.

This masterpiece of engineering, built with a heavy Army hand, looked pretty ferocious sitting on the ground – but only Jimmy Doolittle managed to get it around the field.

I can't leave Kelly Field without telling you about the G.A.X. (ground attack experimental). This was a masterpiece of aeronautical engineering with a heavy Army hand laid on. I understand that only two of them were ever built, and if they had tried to fly #1 first they would have quit work on #2. The one I refer to was housed in a large hangar on the far side of the field. It was a large biplane powered by four liberty engines, gunner's cockpits forward and aft and half inch armor all around the two pilot cockpit. It looked pretty ferocious sitting on the ground but the main trouble with it was that it had a ceiling of about 200 to 300 feet on a cool day. The only time I saw it fly was when we put on an aerial revue for General Patrick, Chief of the Air Service. Jimmy Doolittle managed to get it around the field twice at full throttle with very, very shallow turns.

Next month I'll tell you about my return to civilian life and of some of my first "gypsy" flying experiences.



Looking West

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

PANORAMA POLLYANA?

"PACIFIC TELEPHONE FILES SUIT AGAINST 73 MAGAZINE" . . . and now that we have your attention we shall move on to other matters. Not that I don't have my own opinions on this historic event — I just do not feel that Looking West is the proper place to express them. There is just too much other news to report and events to cover to justify steering this column in that direction. Therefore, Looking West will still be the same old column you have come to know these past few years and thanks to this magazine's editorial policy, I will be able to cover the aforementioned legal action elsewhere in print. I assure you that I will be far from silent on this issue, since it affects the future of each of us — both as individuals and collectively.

I have a rather strange policy in writing this column. I have no interest whatever in printing items that tend to bring down amateur radio or, through innuendo and gossip, to in any way bring harm to any individual or group within the amateur community. It is my feeling that there are enough individuals devoted to doing just the opposite, and someone has to point out the good and dwell upon it. Apparently most of you seem to agree with this policy. As a direct result of it, we have been able to bring you the type of news items that you seem to enjoy. On the other hand, some have accused me of being a "Pollyanna" — what they say is dig deep and give us the dirt. To those I say please look elsewhere since I have no intention of changing my policy; you will find the good news here and the "dirt" will have to come from someone else.

With the aforementioned in mind, I am happy to report that it looks as if the California Amateur Relay Council, a state-wide VHF/UHF frequency coordinating body, has survived its internal political unrest and will re-organize its structure along the lines of the report submitted by the "Blue Ribbon Panel" organized for that specific purpose. In its final report given June 7 at Santa Barbara, it was recommended that regional management be adopted with given individuals or groups being appointed to oversee the needs of these areas in relation to spectrum management as well as other forms of peripheral support to all special interest groups involved in FM communications. There would be Northern, Southern 144/220 and Southern 50/450 and up coordinators assigned initially with invitation left open for other interests to join as well.

Executive and administrative affairs of the Council at large will be administered by a body comprised of the Chairman, Secretary and local area managers, whose duties will be to direct Council-wide activities. What has actually been done by the "Blue Ribbon Committee" is to apply common modern business management technique to an amateur organization, thereby permitting local needs to be cared for on a local level while at the same time stressing the need for total unity on a statewide basis. It took the committee four months to prepare this report — four months of gathering information from all available inputs, looking carefully and evaluating the needs of different geographic locations and finally preparing all this data in a form that would make a truly workable new constitution acceptable to all involved. In October, they will meet again, this time to discuss the proposal and decide whether it is the route they wish to guide the future of CARC along. To my eyes, it seems a good foundation upon which to build a viable statewide organization, and I must commend those who gave of themselves for a job well done. If CARC can be reborn on a basis acceptable to all, then we are really going to have something out here.

Art WA6TKO of Henry Radio displays the prototype Kenwood TS-700 2 meter All Mode Transceiver at the LERC Burbank Hamfest.

Where, then, does this leave the Southern California Repeater Association? In a resolution introduced for consideration on a basis parallel to that of the revised CARC constitution, the work of SCRA was noted and it was moved that SCRA be recognized as the Southern Regional Coordinator for 144/220 MHz (and that its elected chairman be considered as fulfilling the duties of liaison coordinator with the CARC Executive Committee). This too will be voted upon in October and the outcome of this vote will actually determine whether a working statewide organization, responsible to the needs of all FM users, is possible. I sincerely hope that such an organization does come to pass. There is a lot more that I wish I had time to cover: the interesting discussion aimed at developing an official CARC response to docket 20282; the direction they voted to take in obtaining official FCC recognition for remote-base operation; and a rather funny discussion as to where to hold their February '76 meeting. Can you believe that Tahoe lost to Los Angeles! I will try to cover more of this in greater depth next month, but at present wish to close by thanking Martin WA6TIC, who provided transportation, and Don WB6HJW, who recorded the meeting for me with my Panasonic RQ-309 cassette tape recorder. Since Saturday is a work day for me, this report would not have been possible without their kind assistance.

I really had not planned on attending this year's LERC Burbank Hamfest but as the event progressed, word kept filtering to me via two meters that Henry Radio was showing a new piece of two meter gear that would possibly revolutionize two meter operation. That I had to see, so I made the 15 minute drive to "Beautiful Downtown Burbank" and

Continued on page 143

LETTERS

from page 132

ETHER THE UNIFIED FIELD?

In the correspondence I have had on the subject of Ether, the biggest question seemed to center on the efficiency of wave travel.

That light and radio waves can survive billions of years of travel from distant galaxies is a direct indication of the near perfect, if not perfect, basic efficiency of their linear travel in space, the decrease of intensity being primarily a function of spheroidal dispersion.

It appears that subatomic "particles" are actually somewhat similar energy-Ether motions trapped in circulatory resonances, the frequencies, number of wave lengths, direction of rotation and number of interlocking resonances setting the characteristics, such as mass, charge, polarity, life, etc. The more stable of these "particles" continue in what amounts to perpetual motion, if billions of years qualifies them for that.

The importance of Ether is its being a perfect base for energy. Is the zero condition of the equation, $E = Mc^2$, fundamentally important and Ether? Is Ether the unified field? How test?

D. H. Gieskieng W6NLB/7
Box 386
Clarkdale AZ 86324

Dave Gieskieng is the author of "Does Ether Cause Gravity?" in our May issue, and is now working on "A Strip Chart Recorder for Everyone". – Ed.

SOONER REPORT

I would like to report on 2 meter sideband activity here in southwestern Oklahoma. First of all, we are on using the KLM ECHO II, which checks out as a very nice rig. When I say we, I mean my wife Rosa WA4KBA as well as me. We are using 2 KLM 9-element beams up about 14 meters and hear Oklahoma City everytime they are on. We normally operate on 145.110 and are listening all the time (squelch). We have ordered a lower sideband crystal from International and should be getting it shortly. KLM now has 144.0 MHz crystals in stock and we have ordered one of them as well. We are getting another ECHO II for the car and hope that we will have good luck with it.

The conversion to both upper and lower sideband is very easy and you are able to bring the switch out to the front panel by using the test switch which is no longer needed with a CW plug in the back. KLM could probably give you a good report on the conversion, or as soon as I get the crystal and other parts I can.

Rosa and I would like to see a lot more activity on 2 meter sideband and hope that the ECHO II and the ITC 2000 will help.

Bob Willsey W4NUL/5
Altus OK

FASCINATING SAGA

Just a quick note to say that I think the April issue is one of the best 73s in the past year or so. It had a nice mix of articles, and I especially liked the article on the phone system. As a pilot for the Air Force, I found W. S. Green's continuing saga fascinating. Some of the events I experienced at pilot training 50 years later sound very familiar.

I would like to see an article on these small decoders that you usually see in your friendly neighborhood CB store for use with a police band receiver. They are simple enough for a CBer to install, and appear to be about $8 worth of parts usually sold for around $40. However, they do unscramble broadcasts.

Alan P. Biddle WA4SCA/5
Jacksonville AR

CULPRIT CAUGHT

CB RADIO
AM-SSB Midland Base with digital clock, slider SSB kick desk mike; Kris (big boomer) Linear Amp. Both AM-SSB and receive pre amp, 300 watts AM-1500 watt SSB; mobile side bander II, AM-SSB plus 50-150 watt mobile linear. Palomar 500 watt SWR (in line) monitor; antenna (1,000 watt) mast and coax; Solid State desk VHF receiver Hi-Lo bands FM, Police, Fire, Weather; antenna and coax included. Other goodies thrown in too. Talk to the world! $900 takes all. 241-3413.

The attached for your perusal. Just cut it out of the ad section of one of our local papers. Use it as you wish, as I didn't know of a better person to send it to than you, as you have always carried the fight against CBers breaking the law as if there was no law. I was blamed for a lot of interference to TV and hi-fi in the neighborhood, until I got all fired tired of it and started an investigation. To make a long story short, I found the culprit, a CBer a short distance from me who was opening an electronic garage door, wiping out TV pictures, including my own, and coming in "loud and clear" on the hi-fi's. Needless to say he is out of business per the FCC and he was running a 1000 Watt amplifier. 5 Watts????? He was taken to court but don't know the outcome. However, we are no longer bothered with that bird and I am no longer being blamed for any kind of interference.

The mag is swell and look forward to receiving it each month. Keep up the good fight, Wayne. It's a good thing that somebody has the "guts" to fight "city hall". It is just too bad that you don't get more support from the other publishers.

Andy Anderson W6QV
Sunland CA

BUYER GUIDED

Your article, "Which 2m Rig For You?", in the May 1975 issue of 73, was very good.

I have been in the market for a new 2m rig for quite some time and did not know exactly what to buy.

After reading through your article several times, I decided a synthesized rig was just what I needed. Then it was just a matter of how much the pocket could afford. I liked the Clegg FM-27B, because of the independent receiver-transmitter frequency selectors.

After scanning through my 73 magazine, I found one of your ads with the FM-27B on sale.

Thanks to your article, I got the features I wanted in the 2m rig and a price to match.

Now, to get maxium use from the 2m rig, you will find a check for $1.50 to cover the cost of your 1975 Repeater Guide. I don't want to cut up my 73 Magazine for the order blank.

Terry Smock WA1RXF
Springfield MA

Continued on page 144

GRR GRRREEN

QST CHANGES SIZE

Honestly, I don't want to be forever carping at ARRL, but dammit, they've gone and done it again! Before you chalk another one up to my constant criticism of the League (which I think is utter hogwash, but I realize that my having the gall to even mention the League in print is an affront to some of the more seriously disturbed ARRL followers), take a look at the facts.

Fact 1: The board of directors decided, without consulting the members, to change the size of QST. This was not a modest change, but one of magnitude, bringing it from the size it has been for over 50 years up to Radio-Electronics magazine size (approximately). Economy move, they said.

Fact 2: The publishers of the other ham magazines have been trying for years to get the League to shave 3/16" off QST so it would match the other magazines and made ad preparation less expensive for manufacturers. This would also, as has been pointed out many times, allow QST to fit modern web offset presses and allow commonly available paper rolls to be used without excessive waste . . . permitting an estimated saving of $30,000 a year just on paper.

Fact 3: Once a magazine fits web paper rolls and presses, the actual size of the magazine is irrelevant and it costs about the same per pound of magazine to print it. This means that pricewise there is nothing much to be gained from going to the 8-1/2" x 11" format over the present size of 73 Magazine other than a loss of face in "going the 73 route."

Fact 4: No mention was made of any decrease in QST subscription rates, so apparently there will be no savings to readers. On the contrary, there undoubtedly will be some extra money coming out of ham pockets as a result of this change. With the size of each page almost doubled, there is no question that the advertising rates will have to be raised substantially . . . and this will inevitably force the prices of ham gear to increase.

Fact 5: The bigger magazine won't match the libraries of ham magazines built up over the years. It will be thinner and floppier and won't stand up on a shelf. Stopping your subscription to QST won't solve the problem because the other ham magazines will be forced to change too, whether they like it or not, and all magazines will come in the unhandy giant size.

So what are the benefits to ARRL members of this move by the board . . . a move made without consulting the members in any way? I have tried and tried to think of one single advantage to the reader of the larger magazine and I can't come up with one.

So, before you put me down as carping, I challenge you to give me a good valid reason for the change.

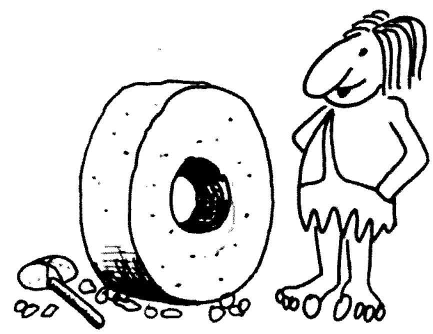
BYTE magazine will be published in the larger size, primarily because this will give more room for the large schematics required for many of the computer circuits these days. No firm decision has yet been made on a change for 73, though I suppose we will have to go along in order to accommodate the new ad sizes.

. . . WAYNE

amsat

Oscar 6 Orbital Information					Oscar 7 Orbital Information			
Orbit	Date (Aug)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (Aug)	Time (GMT)	Longitude of Eq. Crossing °W
12765	1	0135.6	74.5	A	3237	1	0137.9	74.3
12777	2	0035.5	59.4	B	3249	2	0037.3	59.2
12790	3	0130.5	73.2	A	3262	3	0131.6	72.7
12802	4	0030.4	58.2	B	3274	4	0030.9	57.6
12815	5	0125.3	71.9	A	3287	5	0125.2	71.1
12827	6	0025.3	56.9	BX	3299	6	0024.6	56.0
12840	7	0120.2	70.6	A	3312	7	0118.8	69.5
12852	8	0020.1	55.6	B	3324	8	0018.2	54.4
12865	9	0115.1	69.4	A	3337	9	0112.5	68.0
12877	10	0015.0	54.3	B	3349	10	0011.8	52.8
12890	11	0109.9	68.1	A	3362	11	0106.1	66.4
12902	12	0009.9	53.1	B	3374	12	0005.4	51.2
12915	13	0104.8	66.8	AX	3387	13	0059.7	64.8
12927	14	0004.7	51.8	B	3400	14	0154.0	78.3
12940	15	0059.7	65.5	A	3412	15	0053.3	63.2
12953	16	0154.6	79.3	B	3425	16	0147.6	76.7
12965	17	0054.5	64.3	A	3437	17	0046.9	61.6
12978	18	0149.5	78.0	B	3450	18	0141.3	75.1
12990	19	0049.4	63.0	A	3462	19	0040.6	60.0
13003	20	0144.3	76.7	BX	3475	20	0134.9	73.6
13015	21	0044.3	61.7	A	3487	21	0034.2	58.4
13028	22	0139.2	75.4	B	3500	22	0128.5	72.0
13040	23	0039.1	60.4	A	3512	23	0027.8	56.8
13053	24	0134.0	74.2	B	3525	24	0122.1	70.4
13065	25	0033.9	59.2	A	3537	25	0021.5	55.2
13078	26	0128.9	72.9	B	3550	26	0115.8	68.8
13090	27	0028.8	57.9	AX	3562	27	0015.1	53.6
13103	28	0123.8	71.6	B	3575	28	0109.4	67.2
13115	29	0023.7	56.6	A	3587	29	0008.7	52.0
13128	30	0118.6	70.3	B	3600	30	0103.0	65.6
13140	31	0018.6	55.3	A	3612	31	0002.3	50.4

NEW PRODUCTS

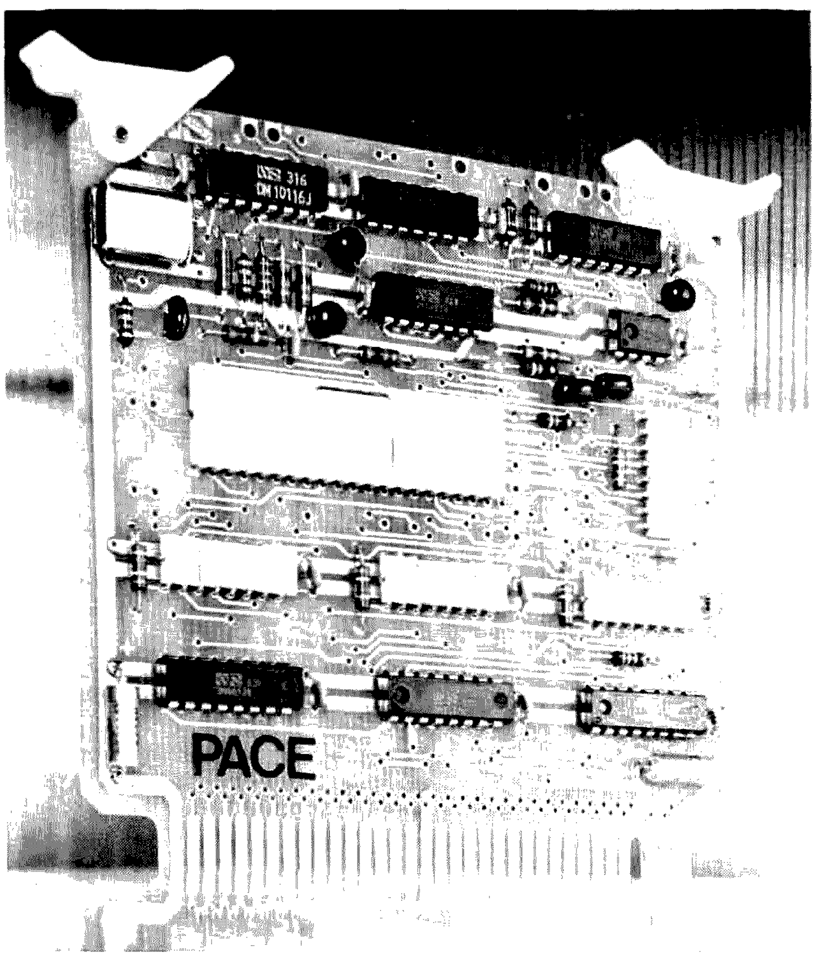


NSC's PACE Microprocessor

One of the most powerful microprocessor chips yet released has been announced by National – The PACE (processing and control element). This is the first of the 16-bit uP (is that a good abbreviation for microprocessor?) and it opens up a bigger and better world to the computer folk.

The PACE chip opens up a new wave of panic for the computer establishment in that it is the next big step in making computers drop substantially in cost . . . a move which threatens the whole distribution system set up to merchandise computers. While computers cost $100,000 or more, sales could efficiently be handled by a factory sales force . . . with trained salesman making the sales . . . factory techs installing the system, and softwear firms aligned with that factory programming the installation.

Part of this mystique resulted from the dominance of IBM (about 80% of the market) and their enormous profit margins. Other major manufacturers found that they had to offer at least as much sales fantasy as the meticulously trained IBM sales teams. Ditto for service, programming, etc. It was a hard act to beat, even with that gold mine of a markup in prices.



This single 4½ inch by 4½ inch printed circuit card contains a complete data processing controller. At the heart of the system is PACE, a single-chip 16-bit microprocessor developed by National Semiconductor Corporation. Other circuits on the board include four DS3608 hex MOS sense amplifiers and three DM8097 hex buffers below PACE, and the crystal oscillator and clock drivers above PACE.

Then came the large scale integrated computer chips such as the Intel 8008 and the 8080 . . . the Motorola M6800 . . . and now the National PACE. Suddenly it was possible to make a central processing unit (CPU) which would do everything a small business could ask . . . not for $50,000, but for $5000 or perhaps even down to $500 if the user didn't mind getting it in kit form.

Computers are more than a CPU . . . you need something to communicate with the CPU and some memory for the CPU to delve into . . . these are still costly, but they too are coming down rapidly . . . to the utter dismay of the computer industry. So far the result has been a nervousness, and myopia. Much of the computer industry has tried hard to ignore these new chips . . . the reaction seems to be that perhaps if they refuse to even read about them they won't exist and threaten the future.

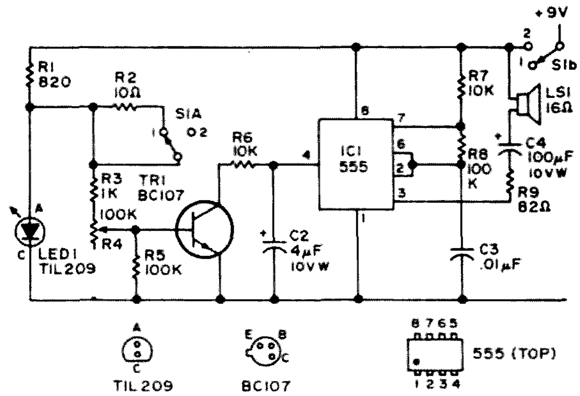
But peripherals are going down in price too, though not as fast as CPUs. How long will it be before some chip company comes out with a single IC for a visual display terminal? There are about 60 ICs in the Southwest Technical visual display generator . . . how long until this is one big chip? Memories are getting smaller and going onto chips too . . . and it only takes about eight of the new memory chips to give a computer all the memory it needs to work.

The CPU has to take the input from a keyboard and sort the material out for suitable filing in the main memory bank . . . which these days is usually a disk of some sort . . . floppy disk for a small amount of memory and a hard disk pack for bigger memories. A floppy disk will, for instance, hold

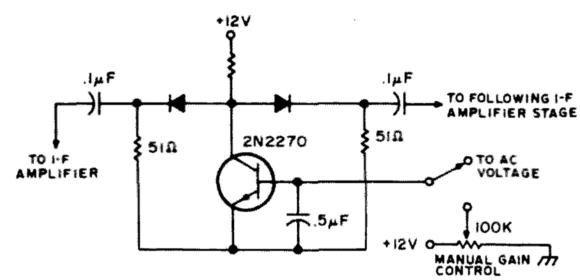
Continued on page 144

TWO NEW

SUPER CIRCUITS



Electronic egg timer. The IC functions as an af multivibrator which is controlled by the external transistor. S1a/b is the on-off toggle switch. (From Radio and Electronics Constructor, May, 1975)



"T" Type Attenuator. This circuit, when inserted in between the stages of an i-f amplifier, acts as a three section attenuator with a dynamic range beyond 60 dB. It can be controlled by a positive voltage from the AVC system or manually by use of a potentiometer. If AVC voltage is negative, substitute the NPN with a PNP transistor and transpose the collector and emitter connections. Don't forget to use a minus supply on the pot. Diode and transistor types are not critical. Pin diodes are the best. Original design used in present home brew receiver. (From W6YUY)

Further Revisions for "Scanning with a Synthesizer" (April, 1975, pages 23-36)

Page 26 – Fig. 3. Unlabeled pin on IC39 is pin 1. Add connection (where they cross) between wires IC20D, pin 9/IC29A, pin 13 and IC26B, pin 5/IC19D, pin 10. Note: Where schematic shows "- - - o" termination (e.g. IC36, pin 3), connect to Vcc.

Page 36 – Parts List. Control board: Push button for "Proceed" switch on Fig. 3 (C12) is 500 pF.

John Gearhart WAØAQO
1408 Dawn Drive
Columbia MO 65201

Ron Fisher VK3OM
3 Fairview Avenue
Glen Waverley, 3150
Australia

Charge that KP202

Bob Goullet VK3BU, 7 Drew St., East Keilor, 3042, has designed and constructed a charging adaptor which most of us would find quite handy. This little unit is ideal if you already have a dc supply capable of delivering 15 to 18 volts at about 100 milliamps. It would also be suitable to use with a twelve volt car system under charging conditions. Another source of voltage often found around the home is junior's model train or slot car power supply. Make sure that the polarity is right and perhaps a series diode might be good insurance. Also, a 1000 mF electrolytic across the output of the power supply would be worthwhile.

The series globe in the adaptor serves two purposes. It acts as a charging indicator and also as a current limiter. In operation the rheostat should be adjusted so that the globe lights to about half brilliance with the batteries in a discharged condition.

The mechanical construction of the adaptor should be fairly clear from the illustration. It was bent up from light gauge aluminum, and the contact studs are simply two 1/8 inch round head screws mounted on a piece of bakelite or similar insulating material.

Another charger, designed by Don Paice VK3ADP, 21 Allister St., MT Waverly, 3149, is completely self-contained with a built-in power supply. The mechanical basis of this is a medium size die-cast box with the KEN holding bracket bent from a piece of perspex after careful heating with either boiling water or a blow torch. After attachment to the diecast box, the whole assembly was sprayed with silver enamel.

Don's unit features quite a few deluxe items. Firstly, a micro switch in the ac line, actuated when the KEN is placed in the cradle. A small meter salvaged from an old Japanese tape recorder serves to indicate charging current. The zener diode across the

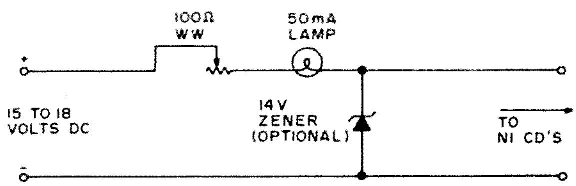
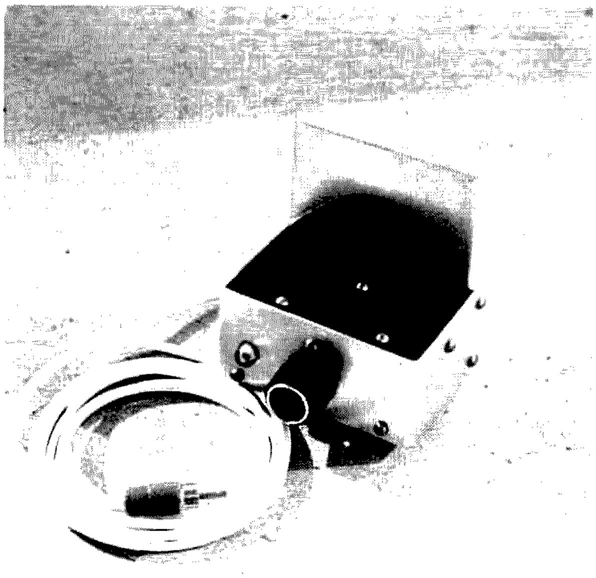


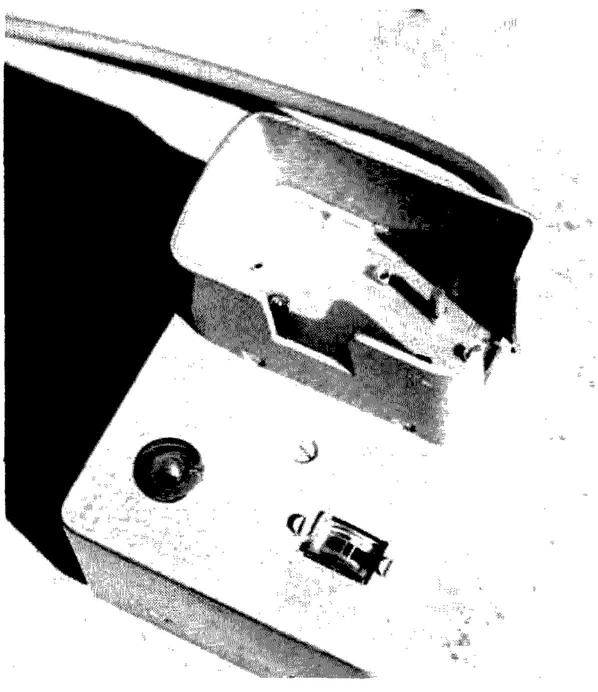
Fig. 1. NICAD Charging Adaptor.

The KP202 sitting in the VK3BU charging adaptor.

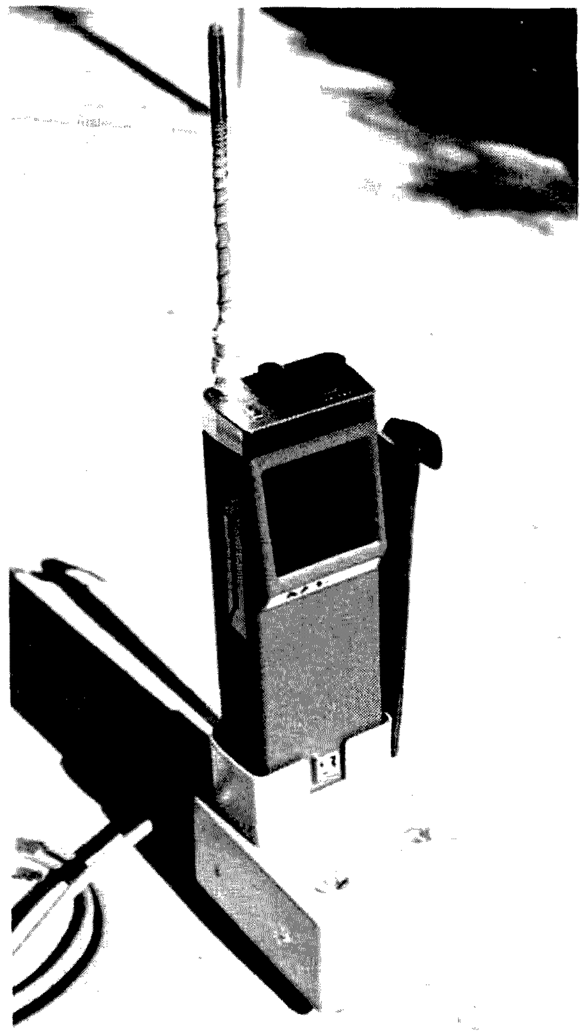
Reprinted from *Amateur Radio,* Journal of the Wireless Institute of Australia, August, 1974.



A close-up of the VK3BU charging adaptor.



A close-up of the VK3ADP charger, showing the ac micro switch actuator.



The KP202 in the VK3ADP charger.

output conducts when the battery voltage reaches 14 volts, and thus prevents over-charging.

In conclusion, a few words about charging nicads:

When on charge, battery temperature should never exceed 38 deg. C. (100 deg. F). Check on published data for your particular batteries for maximum allowable charging current.

The required charging time can be calculated by dividing the amp-hour rating by the charging current, then multiplying this figure by 1.25.

Batteries in series should not be charged unless they are of the same type and in the same state of discharge.

. . .VK3OM

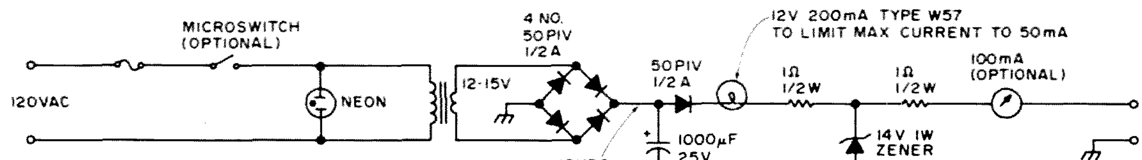


Fig. 2. NICAD PS for KEN KP202.

Ottis Barron (K5BSE), Assistant Professor of Engineering at the University of Tennessee at Martin, is teaching General and Advanced theory to the 11 new Novices of the Reelfoot Amateur Radio Club and to other members interested in upgrading their licenses. The newly formed club is one of the few throughout the nation with a college professor as an instructor.

Radio activities in Union City, Tenn. (pop. 13,500), lay dormant for years until early this year when Willie Pope (standing center) returned to the city and enlisted the aid of fellow ham Glen Leggett (standing left) and Bill Porter to help initiate Novice Radio Class instruction. Eleven persons have already passed their Novice tests and new classes will begin this fall with the goal of tripling the number of hams here within one year's time. The new Novices are, from left: David Critchlow, Jr., Herman Wisniewski, Morris Mahan, Tim Fox, Mrs. Willie Pope, John Row, Jeff Row, Steve Harpole, Lance Hurd, and not shown, Jody Harpole and Jerry Bennett.

BE MY GUEST from page 7

persons indicated an interest.

The classes in code and theory were conducted twice a week for the next nine weeks and, when it was completed, there were 11 new Novices.

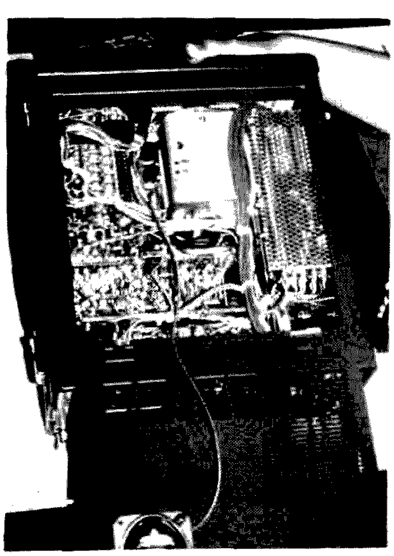
Once the Novices had their tickets, the three instructors felt additional help was needed in order to continue into the General and Advanced fields and a nearby amateur, Ottis Barron K5BSE, assistant professor of electrical engineering at the University of Tennessee at Martin, consented to teach the classes without charge. Within two months, Willie, who had held a Conditional for more than 15 years, upgraded his class to Advanced – and three Generals also moved up one more rung on the amateur ladder.

Now, within a few weeks, some of the Novices hope to try for their Generals and the newly-formed Reelfoot Amateur Radio Club is not only preparing to begin a new class in Novice, but has plans for booths at two fairs, a hamfest, a picnic and two campouts.

If the club meets its goal of 25 new hams in its area this year, the amateur population will have more than tripled in size, in the period of 12 short months.

Talk's cheap – it's the action that counts.

David G. Critchlow WB4CYX
Managing Editor
Union City Daily Messenger
Union City TN



How do they pack so much radio into so little space?

Looking West

from page 134

along with many other attendees of this event got a glimpse of the new Kenwood TS-700 multi-mode two meter transceiver.

The first thing that I noticed was that it did not look like the conventional two meter radio, but much more like a piece of HF gear. When it becomes available in the not too distant future, you will have one radio that will permit you to operate FM (simplex or via your favorite repeater), chat with those still on AM, or at the flip of a switch give you the ability to go hunting DX and the Oscar satellite on CW or SSB. You have a choice of either upper or lower sideband with built-in receiver incremental tuning as an added feature. If it sounds like the ultimate in a radio for two meters, be prepared to spend in the $700 to $900 bracket for this beauty. The TS-700 is dubbed the "All Mode 2 Meter Transceiver" and the quick glance I got of it leads me to believe that it will be well worth the bread. More on this as information is available; in the meantime I hope that the photos will suffice.

Next month we will continue with more on CARC, coverage of the June 21 SCRA meeting at J.P.L. in Pasadena, and a story on the first repeater to go full time microwave control – all with photos I hope. Till then goodbye from those of us who write for the 3:00 am shift in Los Angeles.

. . . WA6ITF

LETTERS

from page 136

HAVING A BALL

Considering I've received *no* response from any of the other publications I've addressed similar correspondence to, your reply was both timely and appreciated.

Therefore and henceforth, etc., please find one(1) each check in the amount of $4 for the back issues of Sept, Oct and Nov 1972 and any possible postage, etc. If you would please pass this request for back issues to inventory control (some fine people, I'm sure) I would be appreciative.

I must say to you that in addition to having a fine magazine (although a bit short on HF) it was 73's fine technical publications that enabled me to get my first ticket while stationed on Okinawa (Conditional) and my upgrade to Advanced in March of this year. By the way, I got that first ticket in June of 74 and although electronics is my avocation I would never have made it to Advanced without 73's help. Thanks. I'm having a ball.

Richard E. Snider WA7YYA/4
SSG, USA
Warrenton VA

Sergeant Snider refers to a technical query he addressed to our editorial staff — Ed.

ARRL ERROR?

We think that the ARRL is making an error in holding its National Convention in Reston, Va.

Reston, Va., has very restrictive antenna regulations and it does not allow outdoor antennas on its town houses (cluster housing).

We feel that the League should not hold its convention in a community that is so hostile to amateur radio.

Kay Alston WN3ZCE
Nick Leggett WA3YFU
Washington DC

REALLY GOOD

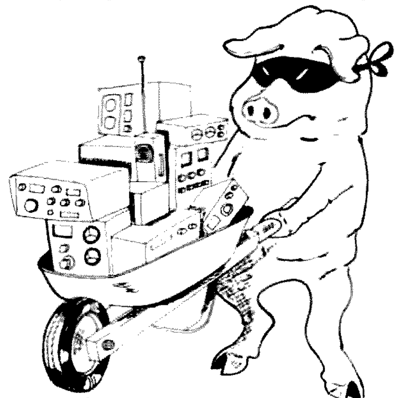
You might like to know that the Lake Amateur Radio Association, "K4FC", has just started another Novice class, using Wayne's tapes — they're really good.

Ken Aitken W4FIQ
Tavares FL

STOLEN: 2 meter FM transceiver consisting of VHF Engineering transmitter strip and 10 channel deck in black box mounted on top of Heathkit GR-110 scanning receiver, with touchtone pad on transmitter. Contact WA1UZE, 7 Gertrude Ave, Runford RI 02916.

TAKEN: FM transceiver, Regency HR2A with Topeka FM Eng. additional 6 channel transmit conversion. S/N 04-07415. Contact W. H. Faulkner, Jr., W4DO, 6475 Chapman Field Drive, Miami FL 33156. 305 666-9614.

RIPPED OFF: Clegg FM-27B, S/N 27053-1854, May 15, 1975. Contact W4PJG or Ft. Myers, Florida Police Department. Dr. Louis Persons W4PJG, Box 1647, Fort Myers FL 33902.



The Hamburglar
STRIKES AGAIN!

SWIPED: ICOM IC30A, S/N 3803043. Contact Richard F. Helvey, 2207 Central Ave No. 209, Billings MT 59102.

NEW PRODUCTS

from page 138

about 3000 names and addresses for a mailing list. A hard disk can manage 60,000 names! The CPU has to be able to print these out on a CRT or on a line printer . . . or a Teletype machine. The magic is in getting the names into and out of the memory quickly in whatever order you want them.

If you are using the system for bookkeeping, then you want the CPU to be able to add and subtract for you. The programmer has to put instructions into the system which will tell it how to respond to the input . . . usually a keyboard. The process is not simple.

Unless you are into computers, the great benefits of the PACE chip over the other microprocessors will be lost on you. It does have some sterling benefits . . . okay?

HAM HELP

Gerald J. Hughey
107 New Street Apt. 303
East Orange NJ 07017
(201) 672-9276

According to long-standing policy, *73 Magazine* makes a continual effort to match those in need of technical help or instruction with those who feel they can offer it. If you find yourself in one of these two categories, please do yourself and amateur radio a favor by contacting Ham Help, *73*, Peterborough NH 03458.

Please add my name to your list of Ham Helpers. I have had CW, RTTY, AM, SSB, building, antenna and mobile experience, and would be especially interested in helping CBers get off 27 MHz and into legitimate radio. And I say that without malice towards any CBer who wants a ham ticket.

Bob Isselhard K5INW
2100 North Cielo
Hobbs NM 88240

I would like to offer my help to anyone needing help with home brew equipment, tube or solid state, and antennas and antenna tuners.

Tom Cullen Jr. K1WXK/W1NXZ
2 Westview Dr
Wallingford CT 06492

OUR APOLOGIES . . .

To George Allen W1HCI and VHF Engineering, for including incorrect pictures of the PS12C and PS24C power supply kits with George's recent New Product Review (July, 1975, p. 147). Look for photos of the impressive real McCoys in an upcoming issue of 73 . . .

Bob Lindecrantz K7PVZ
14609 201 Avenue S.E.
Renton WA 98055

So You Want Front-to-Back Ratio?

It all started on the drawing board with a 5-element, widespaced beam – from there to six; then the idea struck me to add two more elements – why not two reflectors. This started to get me in the ballpark. After trying a number of different spacings, and receiving reports from near and far on the changes, I arrived at the present design.

I ran several constant checks with K7UWZ, Renton WA, W7WDZ, Bainbridge Island WA, and W7BVV, Salem OR. All reports revealed a front-to-back ratio of 48 dB with little or no signal off the sides. Subsequent worldwide reports have been outstanding. I knew this was what I was looking for.

The elements are 7/8 and 3/4 inch aluminum tubing. The boom is three 10 foot sections of 2¼" diameter aluminum. Each end is threaded so they can easily be joined together with a coupling sleeve.

The driven element was cut and tuned for 29 MHz using a grid dip meter at the element with the gamma disconnected. This is one thing that most hams don't do, and this is the most important part of the antenna – to get that driven element on the resonating frequency. After the connection of the gamma to the beam and subsequent adjustments, the swr at this frequency was 1.1:1. The rest of the elements were figured from the antenna handbook for 29 MHz.

All three reflectors are the same length; the spacing of the reflectors was very critical as far as front-to-back ratio was concerned until I arrived at the spacings as shown in the illustration.

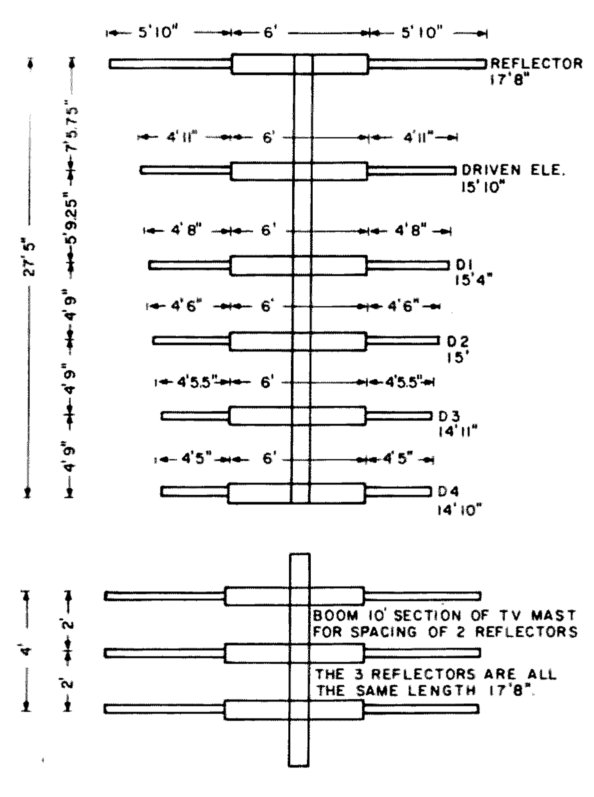


Fig. 1. End view of 3 reflectors. Note: The above spacing resulted in very, very good front-to-side and front-to-back ratios.

The mast for the two reflectors is a 10 foot section of TV mast mounted to the boom in the same manner as the boom is mounted to the mast.

The spacing between the reflectors and the driven element is .22 wavelength, and spacing between the driven element and director 1 is .17 wavelength; the remaining directors are evenly spaced 4'9" on the boom.

The boom length is 27'5" and each end is supported with nylon cord to a center mast to keep the ends from drooping.

The antenna is 57' above the ground, and mounted on a crank-down, tilt-over tower.

The gamma is out of the antenna handbook.

One other experiment I ran was to extend the boom another five feet to add a ninth element (director). By doing this the results were about the same as with the eight elements – practically no improvement.

With a little extra effort, you can be on the air with a high power signal running QRP power.

. . .K7PVZ

Caveat Emptor?

PRICE – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

MANUFACTURERS, Distributors! The Memphis Hamfest will be bigger than ever. The dates are Saturday and Sunday October 4 and 5. Best location possible – State Technical Institute, Interstate 40 at Macon Road. Security. Contact Chairman, Harry Simpson W4SCF, Box 27015, Memphis TN 38127, phone (901) 358-5705.

TWO PLASTIC HOLDERS FRAME and display 40 QSL's for $1.00 or 7 holders enhance 140 cards for $3.00 – from your Dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin, Tennessee 37066.

R-390A/URR – like new, recent overhaul with manuals and connectors. $500. WA1TEJ 603 880-2788 days.

AN/FGC-20 – RTTY TT-100/FG Kleinschmidt printer, like new, with table, 60, 66, 75, 100 gears and manual. $150. WA1TEJ 603 880-2788 days.

STANDARD 830L-3 Hi-band 3 channel 2 Watt HT less accessories. $100. WA1TEJ 603 880-2788 days.

SNOOPERSCOPE M-3-20KV infrared see-in-the-dark telescope in excellent working condition with power supply. $150. WA1TEJ 603 880-2788 days.

HALL OF FAME HAMFEST and auction rain or shine, Aug 3, 1975, Canton, Ohio. Come to Canton for football's greatest weekend. Saturday's activities – parade, enshrinement, NFL game Cincinnati vs Washington. Sunday – hamfest and auction at Stark County Fairgrounds. Main prizes – ICOM 230 – Hallicrafters FPM 300 – Standard 2 mtr hand held. Motel and camping space available. Call WF8HOF 146.19/79 or 146.52/52. Further information write WA8SHP, 73 Nimishillan St., Sandyville, Ohio 44671 or call W8SWB (216) 455-4449.

WANTED – Make, Model and Serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma WA 98466.

AN/URA-8A – complete RTTY diversity group: 2 CV-89A/URA-8B converters, CM-22A/URA-8B comparator, MT-719/URA-8B cabinet, connectors and manuals all like new. $250. WA1TEJ 603-880-2788 days.

SWAN, CushCraft at prices I dare not publish. Call or write WØNGS, Bob Smith Electronics, 1226 9th Avenue North, Fort Dodge IA 50501. (515) 576-3886.

Continued on page 152

Caveat Emptor?

from page 150

FB CONDITION SBE-34 ACDC transceiver $195. HRT-2 Regency HT W-4 rocks, cost $200 plus. (Sell 4 $145.) Kenny, 455-41st Ave., SF 415-386-6313. Hot Water 17A with FM-adapter 2m transceiver. Visit Singapore . . . the best Country in the WORLD.

SSTV MONITOR, W6MXV, PC boards factory checked, with extra 7" CRT and 2 cassettes – $85.00 – you pay shipping. WA4TST, 507 Pinecone Street, Waycross GA 31501.

TECH MANUALS – $6.50 each: R-220/URR, SP-600 JX, USM-159, GRR-5, URM-25D. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

FOREIGN LANGUAGE cassettes. 2 – 60 minute quality tapes per set. French, German, Italian, Spanish. $6 a set, 4 sets $20. Royal, Box 2174, Sandusky, Ohio 44870.

CINCINNATI HAMFEST: 38th annual – Sunday, September 21, 1975 at the New Stricker's Grove on State Route 128, one mile west of Ross (Venice), Ohio. Flea market, contests, model aircraft flying, food and beverages all day. Advanced tickets $7, covers everything; $8 at gate. For tickets or further information: Carl J. Dettmar W8NCV, 8630 Cavalier Drive, Cincinnati OH 45231.

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester NY 14612.

WARREN HAMFEST! Sunday, August 17, Yankee Lake, Ohio. On Rt. 7, five miles north of 180. Dealers' displays. Swimming and picnicing. Giant flea market (Vendor's fee: $1.00 plus registration). A $3.00 registration includes: Door prize, Main prize, and XYL tickets. More info: Hamfest, PO Box 809, Warren OH 44482.

WANTED used Bruel and Kjaer audio test equipment measuring amp, spectrometer, pistonphone, hearing aid test box, chart recorder. Contact Bob Sumption, Berrien County Day Program for Hearing Impaired Children, Sylvester Boulevard, Berrien Springs, Michigan 49103.

STANDARD 840ZA carrier squelch pocket paging receiver, like new, now on 154.19, with charger and spare nicad. $125. WA1TEJ 603 880-2788 days.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945-75. Indispensable!)

FOUNDATION FOR AMATEUR RADIO annual Hamfest Sunday, 19 October 1975 at Gaithersburg Maryland Fairgrounds.

GE – PREPROGRESS 450 MHz base station transmitter with oven and power supply, 12 Watts out, 4ET19A1. $25. K. Bassett, 1124 Woodrow Ave., Waynesboro VA 22980.

POLICE AND FIRE Scanner Special – Regency ACT – R – 10 H/L/U 10 channel 3 bands, combined ac/dc 10 free crystals included $169.00 prepaid, dealer inquiries invited, Four Wheeler Communications 10-F New Scotland Avenue, Albany NY 12208.

Continued on page 154

Caveat Emptor?

from page 152

MEMPHIS is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, on Saturday and Sunday October 4 and 5. Demonstrations, displays, MARS meetings, flea market, XYL entertainment, prizes. Informal dinners Saturday night. Dealers and distributors welcome. Talk-in on 3980, .34-.94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis TN 38127 or telephone (901) 358-5707.

FOR SALE: Clegg 66er BRAND NEW 6 meter 117V ac & 12 V dc. Built-in P.S. and Manual. $120 + UPS. Heathkit SB301 w/filters, SB600. SB401 w/xtal Pack & Manuals Mint $460.00 + shipping. Henry 2K-4 linear amp console mint $585.00 + shipping. J.A. La Torre, P.O. Box 521 G, Lawrence MA 01842.

F.R.R.L. HAMFEST – August 17th. U.S. Rt. #30 East of Aurora, Ill. Phillips Park – Picnic – Zoo – Family Fun. Advance Donation $1.00, $1.50 at Park. S.A.S.E. to P.O. Box 443, Aurora, 60507. Two Grand Prizes and many others.

NO DX QSLs? Try ham sentences in 54 languages on your card! "K3CHP's DX QSL GUIDE," $3.95. Joe Mikuckis, 6913 Furman Pkwy., Riverdale MD 20840.

WANTED: Full correspondence course of computer digitals and ICs from someone who has moved up in the field. State price. Cyril Lievesley, 142 Brightman St., Fall River MA 02720.

FREE: 8 EXTRA CRYSTALS of your choice with the purchase of a new ICOM IC-22A at $249. With the 10 crystals which come factory-installed in the IC-22A, this gives you a total of 18 crystals! For equally good deals on Kenwood, Drake, Collins, Ten-Tec, Swan, Atlas, Midland, Standard, Regency, Tempo, Alpha, Genave, Hy-Gain, CushCraft, Antenna Specialists, Hustler, Mosley and others, write or call HOOSIER ELECTRONICS, your ham headquarters in the heart of the Midwest, and become one of our many happy and satisfied customers. Hoosier Electronics, P.O. Box 2001, Terre Haute, Indiana 47802. (812) 894-2397.

THE ORIGINAL FM Hamfest Aug. 3, 1975, near Angola, Ind. Free flea market, picnic grounds, swimming, boating available. Talk-in on 146.16-76, 146.94. For information contact Fort Wayne Repeater Association, Box 6022, Fort Wayne, IN 46806.

WANTED: Mobile telephone equipment such as Delco, GE, etc. Also heads, decoders, duplexers. Greg Hyman, WA2OTG, 19 Sicard Ave., New Rochelle, New York 10804, (914) 636-2494.

GPL – TELEVISION SYSTEM, PD150 camera with lens and book, 18 inch Conrac monitor. $140. K. Bassett, 1124 Woodrow Ave., Waynesboro VA 22980.

WANTED to buy – TRIBAND ANTENNA. FOR SALE – TR106 & VFO $75.00; Clegg FM27B & AC $250.00; Clegg Mark II $150.00. Ameco TX62 $40.00. Swan 350/AC and upper lower sideband adaptor, VOX, and factory installed VFO. All guaranteed perfect condition. Duane Kilbourn, 17100 14 Mile Rd, Battle Creek MI 49017.

AN OFFER you can't refuse – BUYERS & SELLERS P. 148.

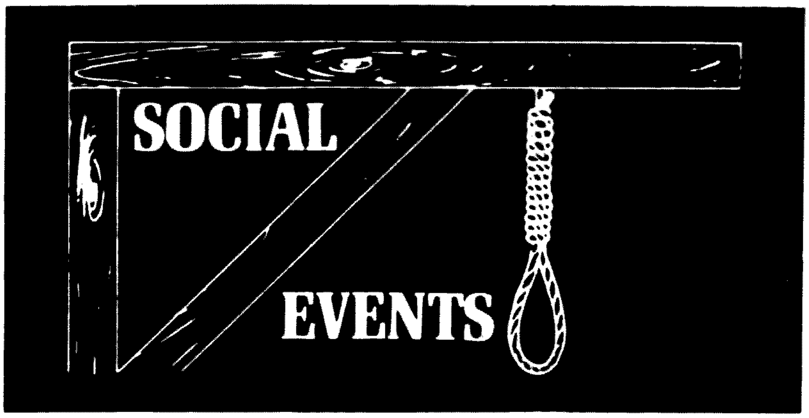
RADIO ARCHIVES, amateur ANECDOTES (then & now) solicited for proposed (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 fourth St. N., Mpls., Mn. 55412.

THE 28th ANNUAL Turkey Run Hamfest and VHF Picnic sponsored by the Wabash Valley ARA, Inc., will be held Sunday, July 27, at Turkey Run State Park near Rockville, Indiana. Don't miss the midwest's finest flea market. XYL Bingo, refreshments, camping facilities and park recreation for the kids. Also this year, banquet July 26, 7:30 pm featuring guest speaker W9NTP, in park dining hall. Banquet by reservation only, $6.50/person; reservation deadline July 1. Activities begin 9 am Sunday, talk-in 146.94 W9UUU/9. For details, tickets and banquet reservations SASE WVARA Hamfest, Box 81, Terre Haute IN 47808.

HAMFESTERS 41st Hamfest and Picnic, Sunday August 10, 1975, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OMs and XYLs, famous Swappers Row. Information contact John Raiger K9DRS, 8919 West Golfview Drive, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 South California, Chicago, Illinois 60629.

HP-65 USERS exchange ideas, programs, methods. Monthly newsletter. Request information and sample newsletter. Richard Nelson, 2541 W. Camden Pl, Santa Ana CA 92704.

MOTOROLA HANDIE-TALKIE WANTED. Also want accessories. Sidney Helperin, 5046 Veloz Ave., Tarzana CA 91356. (213) 345-6760.



CALGARY ALBERTA
AUG 1-3

Century Calgary Amateur Radio Convention – CARF National and ARRL Canadian Division Convention. Speakers include astronaut Dr. Owen Garriot K5LFL (Skylab 3, 24.4 megamiles in 59 1/2 days orbiting Earth), Martin Laine OH2BH – DX, Larry Kayser VE3QB – AMSAT, Lew McCoy W1ICP – ARRL – quads and humor, Dr. F. Green VE3IO – D.O.C. – on interference, Dr. J. S. Belrose VE2CV – D.O.C. – antennas, Dr. E. Hara – D.O.C. – fiber optics. Bill Porter W3AAC-K1YPE/VE3, US Ambassador to Canada, has also been invited.

Pre-registration $5 til end of June; registration at door $7.50 starts at noon August 1. Various special interest breakfasts, luncheons and tech sessions Saturday, August 2. Banquet $14.50 with K5LFL talk. Tech sessions Sunday also. The convention will be held in the Calgary Inn; rooms available at 1973 rates ($20-25 compared to $30-38). Camping available north and west of town. Info write Convention '75, Box 592, Calgary, Alberta T2P 2J2.

TEMPLE TX
AUG 1-3

The Texas VHF-FM Society will hold its Summer Convention 1975 Aug 1, 2 and 3 at The Ponderosa Inn in Temple, Texas. This year's convention will be the best ever with the featured speaker Mr. A. Prose Walker, Chief of the Amateur and Citizens Division of the FCC. There will also be equipment displays, technical sessions, a swap-fest, ladies activities and many, many prizes. For more information contact the Temple VHF Repeater Association, PO Box 23, Temple, Texas 76501.

WINCHESTER VA
AUG 2-3

The Shenandoah Valley Amateur Radio Club will present its 25th Annual Hamfest in Winchester, Virginia, on August 2nd and 3rd, 1975. The festivities start Saturday night at the Lee Jackson Motor Inn with the Social Hour beginning at 6 pm. Buffet-dinner will be served at 7 pm, after the dinner there will be guest speakers and musical entertainment. Dinner – $6. Fleamarket starts Sunday 10 am till 4 pm. Registration tickets are $2 or $5 for 3 tickets or $10 for 10 tickets. For more information contact the Shenandoah Valley ARC, Box 139, Winchester VA 22601.

Continued on page 156

MORE SOCIAL EVENTS

OKLAHOMA CITY OK
AUG 2-3

The Oklahoma Ham Holiday and State ARRL Convention will be held Saturday and Sunday, August 2 and 3 in Oklahoma City OK. In addition to the largest flea market in the Southwest, the program will include special programs, technical seminars, equipment displays. MARS meetings and unique activities for the XYL. For information and advance registration write Oklahoma Ham Holiday, P.O. Box 20567, Oklahoma City OK 73120.

UPPER ST CLAIR PA
AUG 3

The 38th Annual Hamfest of the South Hills Brass Pounders and Modulators will be held on August 3rd, from noon till dusk, at St. Clair Beach, Upper St. Clair Township, 5 miles south of Mt. Lebanon on route 19. Swap and shop, picnic space and swimming for the family. Mobile check in on 29.0, 52 simplex and popular 2 meter frequencies. Information and pre-registration at $1.50 per ticket ($2 at door) from Fred Schreiber, 181 County Line Road, Bridgeville PA 15017.

ANGOLA IN
AUG 3

The original FM Hamfest will be August 3, 1975, near Angola, Indiana. Free flea market, picnic grounds, swimming, boating available. Talk-in on 146.16-76, 146.94. For information contact Fort Wayne Repeater Association, Box 6022, Fort Wayne IN 46806.

CANTON OH
AUG 3

Hall of Fame Hamfest and Auction rain or shine, Aug 3, 1975, Canton, Ohio. Come to Canton for football's greatest weekend. Saturday's activities – parade, enshrinement, NFL game Cincinnati vs Washington. Sunday – hamfest and auction at Stark County Fairgrounds. Main prizes – ICOM 230 – Hallicrafters FPM 300 – Standard 2 mtr hand held. For more info write WA8SHP, 73 Nimishillan St., Sandyville OH 44671 or call W8SWB at (216) 455-4449.

LEVELLAND TX
AUG 3

The Tenth Annual Northwest Texas Emergency Net Swapfest and Picnic will be held in the City Park at Levelland, Texas on Sunday, August 3, 1975. Bring your own picnic basket. Free registration begins at 0900. Lunch at 1300. Swapping all day. This event is for the entire family. Mobile talk-in is the net frequency of 3950 kHz and via the Levelland Repeater (WR5AFX), on 28-88.

MONTREAL
AUG 3

The Montreal Hamfest will be held Saturday, August 3, 1975, 9 am to 5 pm, MacDonald College Farm, Ste. Anne de Bellevue, PQ, on the west end of Montreal Island, Exit 26 off the Trans-Canada Highway. Admission $2.50 includes prizes, fleamarket, tech sessions, exhibits, mobile clinic (2 m) and an International Tug-o-War. Activities for XYL and kids. Talk-in VE2RM (146.40) 147.00, VE2PY 146.88 (English), VE2XW 146.70, VE2DN 146.76 (French), VE2BG 147.06, 146.52 simplex (both). For more info write Montreal Hamfest c/o VE2RM Inc., P.O. Box 201, Pointe Claire-Dorval, PQ.

WASHINGTON MO
AUG 3

The Zero-Beaters ARC will hold their annual hamfest on Sunday, August 3rd, at the Washington, Missouri city park. Free parking, auction, and bingo for the XYLs. No admission fee or fee for parking in the traders row. Many prizes including IC-22A, station accessories, books and a handmade quilt. For info or tickets contact Kevin Weiskopf WBØMNP, or Zero-Beaters ARC, WAØFYA, Box 24, Dutzow MO 63342.

RENO NV
AUG 9

Nevada Amateur Radio Association will host the annual "Sierra" Hamfest, August 9th, at the California Building, Idlewild Park, Reno, Nevada. Preregistration, $10. For information, contact NARA, P.O. Box 2534, Reno, Nevada.

FLOURTOWN PA
AUG 10

The Mt. Airy VHF Radio Club (The Pack Rats) will hold their 19th Annual Family Day & Picnic on Sunday, August 10, 1975 (rain date August 17th) at the Fort Washington State Park, Flourtown PA. The Delaware Valley chapter of QCWA will again join us in the festivities. All hams and their families are cordially invited. Games and entertainment, free prizes to the kiddies, free soda. Talk-in on 52.525 MHz FM – 146.52 MHz FM – 222.98/224.58 MHz FM repeater. Registration $2 per family.

WILLOW SPRINGS IL
AUG 10

The 41st Hamfest and Picnic will be held Sunday, August 10, 1975, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OMs and XYLs, famous swappers row. Information contact John Raiger K9DRS, 8919 West Golfview Drive, Orland Park, Illinois 60462. Tickets write Joseph Poradyla WA9IWU, 5701 South California, Chicago IL 60629.

HILLIARD OH
AUG 10

The Central Ohio Radio Club, Inc., will sponsor a Flea Market Hamfest Auction to be held Sunday, August 10, 1975 from 8 am to 6 pm rain or shine at the Franklin County Fairgrounds, Hilliard, Ohio (just west of Columbus). Flea market, free auction, main prizes: Midland 30 Watt 2 mtr FM Mobile unit, Model 13-505, 12 ch., Regency 2 Watt 2 mtr FM hand held unit. Door prizes, XYL prizes, refreshments. Entrance and registration – one (1) ticket @ $2/person (including all prize drawings). For more info write CORC, Inc., P.O. Box 23, Delaware OH 43015.

NEWBURGH NY
AUG 16

Mt. Beacon A.R.C. 3rd Annual Hamfest, Saturday, August 16, 1975, 8 am to 6 pm at Stewart Airport, Newburgh, New York. Inside Hangar E. Flea market and auction, door prizes, free parking. Rain or shine. Talk-in on WR2ABB 37/97, 94 and 52. Admission: $1.00, tailgating $1, under 12 admitted free. For advance tickets write: Marty Irons WB2TBI, 46 Magic Circle Drive, Goshen, New York 10924.

MIDDLEFIELD MA
AUG 16-17

Many activities are planned for both days of the NOBARC Hamfest, August 16-17, at the Middlefield Fair-

grounds, Middlefield MA. Talk-in on 31/91, 43/03, 52 simplex, 34/94, 52.525 and 223.50. Admission $3.00/adult or $5/family. Flea market parking $1/car. For further info, contact Don Huntington WA1IQJ, 11 Sullivan Dr., Granby CT 06035.

DECATUR AL
AUG 17

The Decatur Amateur Radio Club will host the North Alabama Hamfest in Decatur, Alabama on Sunday, August 17, 1975. Location is the campus of Calhoun Junior College at the Decatur-Athens Municipal Airport. Doors will open at 8 am. Tickets $1.00 each will be available at door or in advance from Ken Hixon WB4NLN, P.O. Box 9, Decatur AL 35601. Talk-in on 34-94 and 3.965 MHz.

SAUK RAPIDS MN
AUG 17

The St. Cloud Area Hamfest will be held on August 17, 1975, at the Sauk Rapids Municipal Park from 1000, with registration and eyeball QSO, Swapfest $1.00 per call, refreshments and door prizes. For info contact WAØOTO.

AURORA IL
AUG 17

The F.R.R.L. Hamfest will be held August 17th at Phillips Park, U.S. Rt. No. 30, East of Aurora, Illinois. Picnic, zoo and family fun. Advance donation $1, $1.50 at park. SASE to P.O. Box 443, Aurora IL 60507. Two grand prizes and many others.

YANKEE LAKE OH
AUG 17

The Warren Hamfest will be held Sunday, August 17, Yankee Lake, Ohio, on Rt. 7 five miles north of I80. Dealers' displays. Swimming and picnicing. Giant flea market (Vendor's fee: $1 plus reg.) A $3 reg includes: Door prize, main prize and XYL tickets. More info: Hamfest, PO Box 809, Warren OH 44482.

BRANCHVILLE NJ
AUG 23-24

The 550 Club – Oakland Repeater Association will holds its Family Piknik on August 23 and 24 at the Harmony Ridge Campgrounds, Mattison Road, Branchville, New Jersey. Flea market, Door prize TR22C, bring your own food, beer and soda provided. Hidden transmitter hunts (bring your handy talkie), hiking, contests. Talk-in 147.49-146.49 repeat 10-70 & 52. Camping fee $4 per day, $5 per day w/water and electric hook-ups. Entrance fee S2 per adult – $.50 per child under 12. Checks payable to 550 Club – mail to: Rick Anderson WB2QOQ, 53 Garside Avenue, Wayne, New Jersey 07470.

BELVIDERE IL
AUG 24

The Bel Rock Hamfest will be held August 24th in Belvidere, Illinois. Advance registration is $1.50. For more information contact: Bel Rock Hamfest, P.O. Box 1744, Rockford IL 61110.

MARSHALLTOWN IA
AUG 24

The Iowa 75 Meter picnic will be held August 24 at Riverview Park in Marshalltown, Iowa. Bring your own table service and a dish for the potluck meal; coffee and soft drinks are furnished. No registration fee. For more info contact Iowa 75 Meter Net, Mary Keener WAØDAG, R.R. 2, Cascade IA 52033.

SPRINGFIELD MO
AUG 24

The Southwest Missouri Amateur Radio Club will hold its annual Hamfest, swap meet, and family picnic on August 24, 1975, at Lake Springfield Park. Our highly successful meeting draws over two hundred radio amateurs and their families each year. Please send any merchandise for prizes or enquiries to me at the following address: Joe Hargis WBØCIW, Secretary, Southwest Missouri Amateur Radio Club, 3228 N. Wildan, Springfield MO 65803.

LAPORTE IN
AUG 24

The LaPorte County Amateur Hamfest will be held 24 August, 1975, at the County Fairgrounds in LaPorte, Indiana, 60 miles East of Chicago. Paved Midway for sellers, inside tables available. On-site camping with hookups. Advance tickets are $1 each, $1.50 at gate. Cold drinks and food available. Contact Dave Nicolaus WB9AOU, RR7, Box 275, Valparaiso IN 46383.

SAN FRANCISCO CA
AUG 29-SEPT 1

The Quarterly NORCAL DXers (Northern California DXers) gabfest will be held Labor Day weekend at the El Rancho Inn, 1100 El Camino Real, Millbrae CA 94030. $1 reg. at door. Emphasis on SWL DXing. Technical sessions, displays, quiz, auction and free refreshments. Door prizes. For more info write NORCAL, Rick Heald, 17412 Rolando Avenue, Castro Valley CA 94546.

MONCTON NEW BRUNSWICK
AUG 29-SEPT 1

The Moncton Area Amateur Radio Club will sponsor the Atlantic Canada ARRL Amateur Radio Convention, August 29 – September 1, 1975 at the Hotel Beausejour, Moncton, New Brunswick. Exhibits, technical forums conducted by ARRL Headquarters personnel, VHF forum, swap shop, buffet Saturday night followed by dance, dinner and entertainment Sunday night, hidden transmitter hunt, etc. Talk-in on 146.28 – 88 and 146.52 simplex. For full information, write: Moncton Area Amateur Radio Club, P.O. Box 115, Moncton, N.B.

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ADVERTISER INDEX

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August – 1975

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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7	7	7	7	7	7	7	7	7A	7A
ARGENTINA	14	14	7	7	7	7	7A	14	14	14	14A	14A
AUSTRALIA	14	14	7B	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	7A	7	7	7	7	7A	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7A	14	14	14	14	14
HAWAII	14	14	7B	7	7	7	7	7	7A	14	14	14
INDIA	7	7	7	7	7B	7	7	7	7A	14	7A	7
JAPAN	14	7A	7	7	7	7	7	7	7	7	7	14
MEXICO	14	7A	7	7	7	7	7	7A	14	14	14	14
PHILIPPINES	14	7A	7B	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	7A	7	7	7	7	7	7	7	7A	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	14	14	14	14	14	14	7
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14	7
WEST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	7	7	7
ARGENTINA	14	14	7A	7	7	7	7	14	14	14	14	14A
AUSTRALIA	14	14	7A	7B	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	14	14
ENGLAND	7	7	7	7	7	7	7	7	7A	7A	14	14
HAWAII	14	14	14	7	7	7	7	7	14	14	14	14
INDIA	7A	7A	7	7	7	7	7	7	7A	7A	7	7
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MEXICO	14	7	7	7	3A	3A	7	7	7	7	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	7A	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	14	14	14	14	14	7
U. S. S. R.	7	7	7	7	7	7	7	7	7A	14	14	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7A	7A	7	7	7	7	7	7	7	7	7
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AUSTRALIA	14	14A	14	14	7	7	7	7	7	7	14	14
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INDIA	7	14	14	7	7B	7	7	7	7A	7A	7	7
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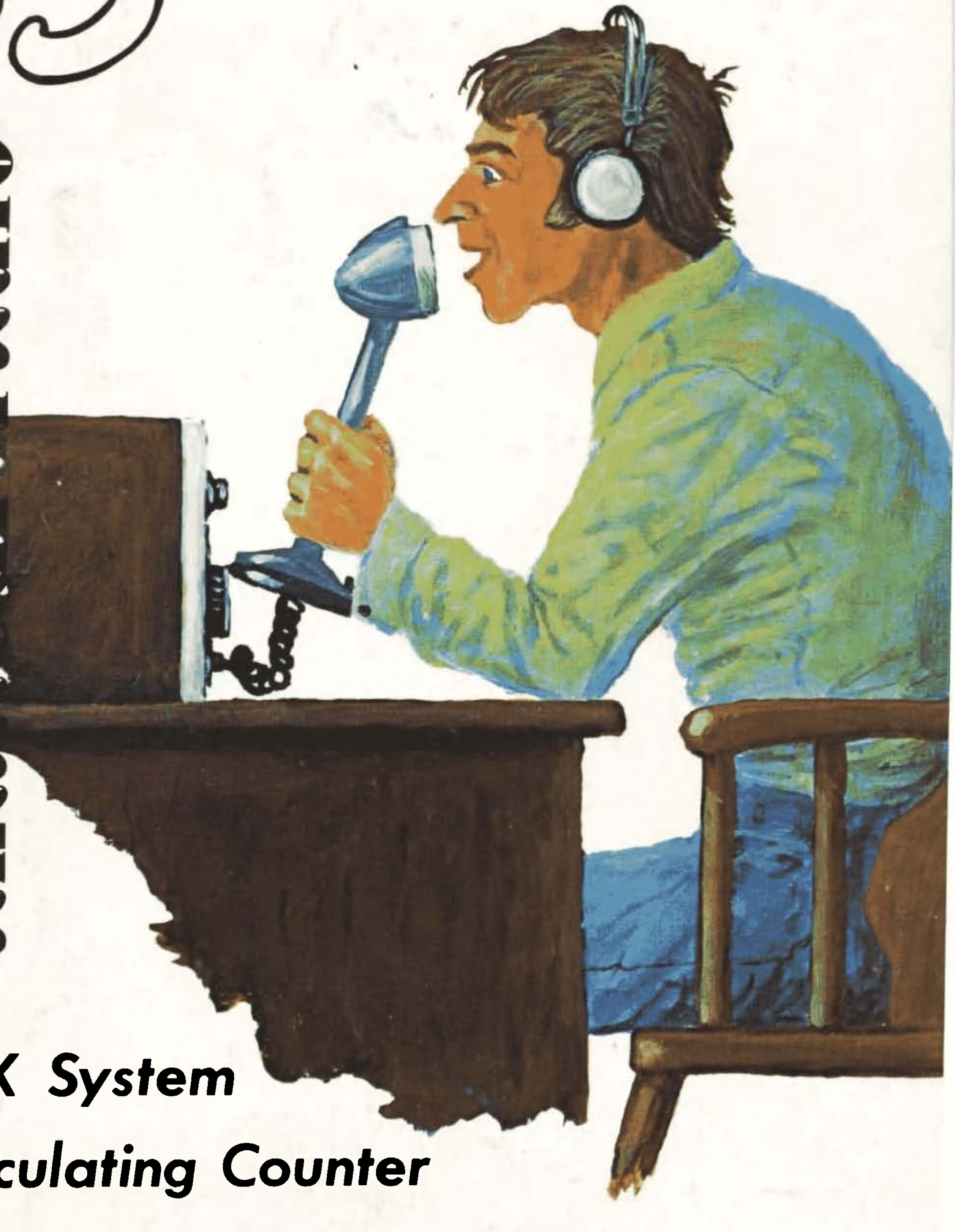
PHILIPPINES	14	14	14	7B	7B	7B	7	7	7	7	7A	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	7B	7B	14	14	14	7
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	7	7
EAST COAST	14	14	7	7	7	7	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 amateur radio

SEPTEMBER 1975
ONE DOLLAR



FAX System

Calculating Counter

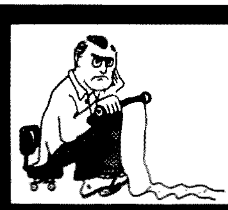
0-60 MHz Synthesizer

73 amateur radio

#180 SEPT 1975

COVER: Oils on Masonite, by Jerry W. Geiger, Delafield WI.

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $8 for one year in North American and U.S. Zip Code areas overseas, $9 per year elsewhere. Three years, $16 and $17 overseas. Second class postage paid at Peterborough, New Hampshire 03458 and at additional mailing offices. Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904.



NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

SECRECY

Amateur and broadcast radio are the two major exceptions to the communications secrecy laws. This means that it is legal to tape record amateur transmissions and retransmit them or play them for others, while it is illegal to do this to CB transmissions, even illegal CB transmissions. Keep in mind that if you ever get involved with recording CBers, that it is illegal. Tapes sent to the FCC, if they have your address on them, can get you in a lot of trouble.

If you happen to hear emergency traffic on other radio services, remember that this is secret and you can't repeat what you've heard.

Section 605 of the Communications Act of 1934, as amended, reads, in part, . . . "no person not being authorized by the sender shall intercept any radio communication and divulge or publish the existence, contents, substance, purport, effect, or meaning of such intercepted communication to any person. . . ."

HOTLINE BYTEN

The first tip of the iceberg for me was the response when we published anything having to do with computers in 73 . . . instant massive reader enthusiasm. Hmm. I started trying to get more articles and also began asking around for information so I would know something about this new field.

RULE CHANGE FOR DEAF PETITIONED

The Mount Diablo Amateur Radio Club has petitioned the FCC to modify part 97.29 of the rules to permit deaf persons to copy code by some method other than ear, as specified in the rules. They suggest receiving via the fingers on a speaker cone or light flashes as viable alternatives. They point out that the present rules discriminate against deaf persons.

Since many of the pioneering developments in RTTY were done by Bob Weitbrecht W6NRM, a deaf amateur, it seems reasonable that this discrimination should be eliminated.

I found that there are a number of small newsletters for computer hobbyists, but not much else. Information was definitely hard to get.

In January this year MITS announced their Altair 8800 microcomputer with a big cover story in Poptronics. I knew right away I wanted one of those . . . it took a while, since several thousand other people had the same idea. A microprocessor for $439 in kit form was a real breakthrough.

The more I was able to learn, the more I could see ahead . . . without turning 73 into a computer magazine there just was no way to cover all of the aspects of this new field. It would take a whole magazine devoted to the subject to do it justice. Hmm, again.

One of the most interesting computer hobby newsletters was being produced by Carl Helmers who, in addition to working full time for a computer firm, was also busy designing and building his own computer system and publishing the data on it. After a couple of talks with Carl the decision was made to go ahead and start a small magazine called BYTE. We thought we might give it a try with perhaps 24 pages and 1000 copies, something we could handle in our spare time.

We started talking it up with possible advertisers and sending out subscription letters on labels they provided. As the response grew, so did the plans for BYTE . . . to 5000 copies, then to 10,000 . . . 15,000 . . . 25,000 . . . and still growing! We had enough advertisers to put out a 100 page first issue, and that meant an enormous amount of work for the whole staff. It also meant that something had to give, for we are working out of a big old colonial mansion and there are just so many offices available . . . and they were all full.

Since Hotline was published more for fun than profit, and since it took an inordinate amount of time for much of the staff to put it out, we reluctantly decided to end it. It was a lot of fun and we'll miss it.

Continued on page 12

FOR YOUR EYES ONLY

Required reading –

by Calvin McCarthy and Eric K. Albrecht K8BFH/1.

THE MOTHER EARTH NEWS HANDBOOK OF HOMEMADE POWER
Bantam Book Y8535, $1.95.

Amateurs today are as concerned about our depleting energy resources as many other people. The sensitivity of a crystal set is limited and it is very difficult to transmit radio energy without a source of electrical power. For the portable and mobile operator this problem is not somewhere over the rainbow, but right beside him. Where will the power come from to talk to the world?

Do you live by a stream? You could power your station by the running water. Do you operate from a windy location? With a six foot propeller in a 15 mph wind you could be extracting 140 free Watts to charge batteries. Do you live on a farm? A South African farmer found in the pig manure all the energy he needed to power his whole farm.

Interested? The HANDBOOK OF HOMEMADE POWER, a pocket book published by the MOTHER EARTH NEWS, gives very detailed and yet readable information on all these subjects. The editors received permission to reprint a five part article from *Popular Science Monthly* on building a stream powered generator. This includes information on calculating the power available in the stream, damming the stream, choosing the water energy to electrical energy transducer, building an impulse wheel, and building an overshot wheel. I can imagine an enterprising amateur building a small portable system for camping trips.

A section devoted to wind powered generators is just as comprehensive, discussing the amount of energy available in the wind, the various styles of windmills with their advantages and disadvantages, circuits, and pitfalls to avoid in setting up a wind generator.

I must confess that the section about methane was the one which compelled me to buy the book in the first place. Every couple of years I would notice a little article of interest in a newspaper or magazine telling of someone running an automobile or motorcycle on gas from animal waste. But how? There never seemed to be mention of how until this book appeared on the book racks with seventy-five pages devoted to the subject. Facts and figures on materials and conditions needed, as well as informative interviews with two men deeply involved with methane production, move the subject out of the realm of magic into the area of practicality. If a pig farmer can get more energy than he needs for his farm, then an amateur should find a way to get enough for a small station.

The most valuable twelve pages of the book contain its bibliography. Here are listed hundreds of sources of information, such as university papers and government publications, plus almost as many sources of hardware with company names and addresses. You will not be at a loss for information. The book was written as a guide, not as the end of Knowledge, and what an exciting sourcebook it is. Read it!

. . . McCarthy

---

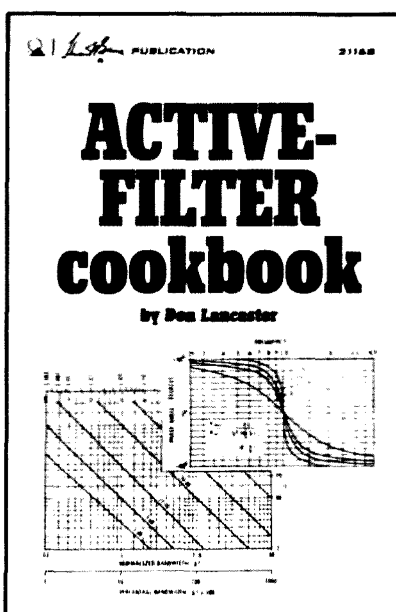
73 solicits reviews of current titles having to do with amateur radio and its periphery. While payment varies according to the size and quality of manuscripts, it is nonetheless uniformly generous. Contact Book Reviews, 73, Peterborough NH 03458.

ACTIVE FILTER COOKBOOK, by Don Lancaster, Howard Sams, $14.95.

For this kind of price, you expect a book to be complete, well written, and practical. This one definitely is. Not only does it tell all about active filters – what they are, how they work, and how to design and use them – it also explains operational amplifiers completely. Aside from being the heart of active filters, op amps are very useful devices themselves, and this book will give you a solid background in using op amps, even if you never build an active filter. But if you do plan to use active filters, this book is a must. As for the math, complete mathematical derivations of each and every type of filter are provided, for those who want it. For those who don't, with the aid of this book you can design your own filters with simple algebra. (Even the "heavy" math derivations are done in high school algebra.)

Not only does the author tell what you can do with active filters, which is a lot, but also he plainly states what you cannot do. For instance, you cannot build a stable, high-Q, easy-to-tune bandpass filter with one op amp. Little pointers like this will keep you out of trouble, while the last section in the book stimulates your imagination, listing a wide variety of applications such as brain wave research, music synthesizers, speech therapy equipment, and touchtone decoders. The ACTIVE FILTER COOKBOOK is a welcome addition to 73's technical library, and it belongs in yours, too.

. . . K8BFH/1



BE MY GUEST

Visiting views from around the globe.

Frankly, my dear...

I know that anonymous communication is not generally well regarded, but in this instance I hope you will permit me to make a few good faith comments without identifying myself. At this point I will feel more comfortable about what I want to say.

I am a non-ham reader of your magazine. I regularly buy QST and 73 every month and enjoy them both, although I find more enjoyment in 73 than any other ham publication I have read. You may not realize that there are a good many of us aspiring hams who read your magazine and, although I try to learn and understand the terminology, I am lost by a good deal of it. Some of the technical articles are far beyond me. I know these articles are important and essential, but I would like to see more articles emphasizing the fun of radio as a hobby. I am always interested in the "personal experience" articles. For some of us who will never be electronic technicians it is a great incentive just to read about the enjoyment that hams have and, believe me, incentive is needed if you have no close ham friends to help you along.

My interest in amateur radio began when I was about twelve years old and I cut yards in the summer. One of my yard jobs was for a ham (now silent key) who was one great guy. He always asked me into the shack (in his attic) where I would sit silently and listen in amazement to the wonders of radio. I am sure that with his help I could have entered the ranks many years ago; however, my parents moved to another town and I lost contact with the ham world. Some time ago my interest was rekindled, and I decided to make a try for a license, but I have met with a good deal of disappointment and discouragement and, at the moment, I suppose I feel my prospects are not too good.

I know there are some people who can buy a license manual and a code record and have their General in three months. Unfortunately, I work long hours, have no background in electronics, and find the going a little rough to handle by myself. I wish I had someone to talk to once in a while, and I would also enjoy sitting in the shack now and then and listening. In spite of all the complaints about the ham population diminishing, however, I find most are not willing to get personally involved. I know one very active ham with whom I have had a casual but friendly acquaintance for a number of years. I wrote a letter to him a few months ago and told him how interested I had become and that I would appreciate talking to him and would love to visit sometime, see his rig and to see him in operation. I made him a little gift which I knew he would enjoy and had it ready to take with me when I got his call. The call never came.

I have tried to meet a few other hams and have probably been a little too forward at times, such as, "Say, I notice by your license plate that you're a ham . . ." or "Isn't that a ham antenna in your back yard . . ." So far everyone has smiled, shaken hands, and been friendly, but the most encouragement I have gotten for the effort has been, "Lots of luck to you, fellow." Gee, thanks.

My ego suffers every time I read about one of those eight or ten year olds who has just gotten his license. But if the truth were known, I'll bet everyone of them had a dad, or a brother, or at least a good friend who gave them a little guidance and encouragement. It helps to be around someone who can talk the lingo. Right now I'm among the uninitiated which is somewhat akin to an Englishman trying to carry on a conversation with a Ubangi.

I am surprised with all of the tremendous mass of material available on technical advancements that so little has been done toward leading the prospective amateur in a systematic way into the ranks. There are thousands of people who would like to join the great amateur fraternity (and I am talking about responsible people who play by the rules, not the ones who enjoy hollering "Super Chicken" and "10-4"), but there is no organized step-by-step procedure awaiting them. I am sure that the manufacturers would like a larger market for their products, but what have Drake, Swan and Yaesu done to provide theory instruction or training for aspiring hams? Look at the advertising in your own magazine. How many ads do you carry of training courses which would lead one to his General license? What I am saying is this, the ham industry has done a much better job in servicing the existing ham market than it has in developing the untapped potential market. Take a realistic look at the figures — CB sales are booming while the amateur ranks are thinning. Many hams seem to take an elite view of their status and to look condescendingly on outsiders. I guess they have nothing to lose . . . but their frequencies.

Don't misunderstand me . . . I am not asking for a lowering of standards. I like the high standards of amateur radio. I agree with many hams that the floodgates should not be opened to a rush of frustrated CBers who will desecrate the airwaves as they have their own (remember that not all CBers fit into this category). I don't mind working to get a ticket. All I'm saying is, I sure could use a little help and a lot of encouragement. If someone would just give me a push once in a while, I could get the theory — and I am not even griping about the 13 wpm. I don't really know any hams, I can't seem to get acquainted, and it's awfully hard for a guy like me, with no helpful background to draw on, to get it all on his own. I plan to keep on trying. But it sure takes guts to work so hard to get into an organization which epitomizes the immortal words of Rhett Butler.

service after the sale

I enjoy your magazine as an "outsider", whose interest is in good writing, state of the art and some day possibly even joining the amateur ranks. I am a Civil Air Patrol "button pushing" communicator who enjoys being of service.

My reason for writing is to tell Mark Poss (*Be My Guest*, July), et al, why we outsiders don't swarm into the amateur ranks. I must say that Mr. Poss sets out an outstanding public awareness program which, if done as he states it, will probably work well. But I am afraid his blueprint stops short of the real problem – which I refer to as the Ham Mystique.

Many of us non-hams have the bug but find it impossible to get reliable advice. I encourage you to try to put your ham jargon out of your mind and wander in to an amateur radio store. Unless you speak the language you probably will not get waited on – and if business is slow and someone does stumble across you he might do you a favor and talk *at* you. Unless you are ready to plunk hundred dollar bills on the counter your average ham hardware store is the best place ever devised in which to be ignored.

Hams continually put down Children's Band operators and clubs – but this group has one big advantage over your average amateur group – they will talk with anyone. When on the airwaves this is one of their big problems, but that's not what I want to talk about.

My point to Poss and company is that you do not need to interest more people in amateur radio. If hams would genuinely open their hearts, minds, clubs and associations to that great mass of people who are anxious to join them, the FCC would be issuing WZ calls within a year.

Be open about your hobby, remember that there once was a day when you didn't know a resistor from a carbon mike and offer your aid to people who seek you out.

It's tough being out here looking in when everyone on the inside has an elitist attitude. As a group, hams and ham hardware houses turn off more potential associates than they could ever hope to attract by the most fantastic public relations programs. It is not enough to simply sell your hobby to the public – you must also provide "service after the sale."

We're out here waiting for your help – what are you going to do about it?

Glenn B. Knight
Milwaukee WI

there's always Hope

Outsiders looking in at amateur radio raise valid points about the seeming indifference of some hams to the plight of the thousands of help-seekers who need aid and can't seem to get it. One YL – Hope Cliver, 10, of Joshua Tree, California – didn't need to go looking around for help: All six members of her family are hams. – Ed.

Hope Cliver, 10, of Joshua Tree, is the youngest General license amateur radio operator in the world, according to the American Radio Relay League.

Hope took the Federal Communications Commission examination in Los Angeles. She passed the radio electronic theory with excellent grades, and the code test at 13 words a minute.

It started for Hope at the Radio Amateurs' Transmitting Society, Palm Desert, headed by Hal Kapp W6WLU. The society initiated an amateur radio class which she attended. Bill Ellis, who drove from Culver City each week, was the instructor for the class.

Hope is the daughter of Betty and Ed Cliver, whose family of six are all radio operators, having held Novice licenses for a year.

She plans to work for her Advanced license while she is still 10, and take her Extra Class examination at the FCC when she is 11.

Hope will work 2, 10, 15, 20, 40 and 80 meters phone and code on her Kenwood TS520 transmitter. She will communicate with thousands of other amateur radio operators located in every nation of the world, including air and sea mobile stations.

With this early beginning she has considerable promise, according to Dr. Fern Stout, president of the College of the Desert, who praised Hope's progress at a recent luncheon of the Desert RATS, a local amateur radio group.

Kelly Shugart

Reprinted from Hi Desert Star, *Yucca Valley CA, June 26, 1975.*

LETTERS

HOW "HOW GATES WORK" WORKED

My thanks to Larry Kahaner WB2NEL for the July article, "How Gates Work" — it makes sense to an old tube man. When I can see the why and how something takes place, the rest is easy. Let's have more.

Earl L. Wiederhold K6SMT/WB6JOC
Bonita CA

Re "How Gates Work": Yes! We need more articles like this one — even giving very simple applications circuits that don't actually *do* much, except work — for those of us who want to learn more.

Phil Morrison, M.D. WA4AXO
Bristol VA

I am writing to compliment you on the article concerning TTL ICs. I found the article interesting and most stimulating to the ole gray matter. Yes, indeed, I feel that there should be more articles printed on the subject of ICs. It seems that in practically every electronic circuit one looks at these days, there is one type or another IC involved. There are quite a few devices printed about in 73 that I and others may like to build, but are held up due to lack of knowledge about ICs. Once again tnx.

Bruce M. Burkhardt WA3MAS
St. Michaels MD

Thanks for the "basics" on TTL ICs in your July issue. Textbooks assume that you know these things — so you duplicate their work without really knowing what's going on. Hope others liked the article, too, so that we can have some more basics from WB2NEL.

V. M. Shaw WA6BTA
Chatsworth CA

Was glad to see the article by WB2NEL, "How Gates Work." Hope he writes another.

Randy C. Withers ex-WN8OQA
Kettering OH

The article in the July issue by Larry Kahaner WB2NEL was excellent and informative. Kindly "cajole" him into doing another similar exposition.

Jerry Hargest WA5ERG

WB2NEL will attack op amps in the October issue. — Ed.

FISHING

I would appreciate your help. The Fisher Scientific Company and its subsidiaries are attempting to compile a roster of ham employees. We are interested in handle, call, branch, position held, and address of home QTH, and ask that Fisher ham employees please contact me at the address below.

Fred Shetler K3VMS
Fisher Scientific Company
Instrument Manufacturing Division
Indiana PA 15701

LOOKING

I am writing on behalf of our newly-formed Lawndale A.R.C., which is in need of transceivers (both VHF and CW/SSB). New or used contributions would be appreciated in order to help our young amateurs get on the air, and any help your readers could offer would certainly be welcome. Please contact: LARC, c/o WA3SZD, 321 Stevens St., Philadelphia PA 19111. Thank you.

Dennis J. Gazak WA3SZD
President, LARC
Philadelphia PA

DOOMSDAY?

Back in my college days, my fraternity decided to do away with a part of the initiation ceremony concerning paddling of pledges. This decision was greeted by a lot of us as a lowering of our standards and with thoughts of the imminent demise of our fine old fraternity.

Naturally none of these dire prophecies came to pass. I find something of the same "Doomsday" concept in comments now being made by hams writing to you concerning the proposed Communicator class license. All because the code requirement is absent they are all up in arms because they took it, and therefore, everybody should in order to get in the "club".

With the Communicator licensed for 144 MHz and above there seems little need for a code requirement as one rarely, if ever, hears it at these frequencies. I've read and heard all the comments about the need to get new blood in the hobby and now that a way exists a great many seem to be saying, "Hey, let's keep it small and cozy." This kind of an attitude is going to lead to even more stagnation than exists right now.

I am not a ham nor am I in CB, but I've listened to both for enough years to know the difference. With a properly formulated and enforced licensing structure most of the idiots on CB will stay there. A little self-policing on the hams' part will take care of those who do manage to get a ticket.

I agree with many of the remarks you made in the June issue and I can understand the attitude that no one wishes to be inundated by a flock of ex-CBers, but not all of us who may get the Communicator license are of this category. There's a lot of good responsible new blood out here who, given the chance, will prove willing and able to uphold the high standards that hams have enjoyed through the years.

Zachary Thomas Taylor
5410 Canal #4
Memphis TN 38118

P.S. If the Communicator fails, at least now we would-be hams know we can get our code practice by listening on 144 or 220! RIGHT?

MANAGING

I would like to inform you that I am the QSL manager of stations A4XFV, DK7PF/HBØ, DK7PV/HBØ, and DLØKJ, for their DXpedition to Liechtenstein (Sept 1-16, 1975, all bands CW/SSB, 10-80m). QSL via DJ7OM. Calls: DK7PF/HBØ, DK7PV/HBØ.

Paul Schmitt DJ7OM
D-657 Kirn
Ubergasse 20
Germany

REALLY GREAT

I started practicing with your 13 wpm cassette and found the transition between it and the 6 wpm cassette quite easy. I plan to go up for my Advanced in 6 weeks or so. I'm still in favor of a reduced speed requirement, but these cassettes are really great!

Fred Findling
Bethlehem NH

WARNING

Your article, "The Ultimate in Variable Selectivity?" (July), prompted me to warn about an often ignored problem when using VC diodes.

What is usually overlooked is that if the signal voltage is a significant percentage of the VC diode bias voltage, the VC diode capacitance is modulated by the signal in an unsymmetrical (and distorting) manner.

Examine the accompanying diagram of a typical FET Hartley oscillator. It is not at all unusual to find several volts of signal at the FET gate. On positive peaks the signal is series opposing to the VC diode bias; on negative peaks it is series aiding. This means that the VC diode capacitance is modulated by the signal in an unsymmetrical manner, producing a frequency (or phase) shift.

A similar effect could occur in your variable selectivity filter if the signal is a significant percentage of the VC diode bias voltage. Hence, the safest place to put the filter would be immediately after the converter stage.

In an FM receiver this could cause audible distortion, and you may never guess what is causing it. I'm not sure what the effect would be in an AM or CW receiver, but it could hardly be desirable.

Searching the literature carefully will lead to the discovery that some (Motorola for one) have published articles on how to compensate for this effect. These circuits usually involve two VC diodes arranged so that the capacitance modulation is cancelled out.

Clyde E. Wade, Jr.
312 S. Cedar
Little Rock AR 72205

Mr. Wade's "The Beauties of Shunt Regulation" will be appearing in an upcoming issue. Editor

MY KIND OF S.O.B.

There are many things that you write in your editorials that I don't agree with, but many times you point out things that I haven't considered — it makes me think again. If you *ever* change your editorial policy, you can cancel my subscription and keep what's left over.

Keep saying it — it needs to be said. I'm saying nothing you don't already know — but keep that needle sharp.

You're right about training the young people. I'm in two radio clubs now, and training is a major topic and effort — there's much talk on the bands about the young people, too. We have to (attract them), Wayne — they're our only salvation for hanging on to the bands we have now. Expansion, at present, is out of the question; we have to first hang on to what we have. Given population, then *maybe*.

One last comment: You're two (2) years too early on *BYTE — it won't make it*. My business is computer engineering, and you're going to sail over the heads of those people you're trying to address. I personally have great difficulty in communicating with a *savvy* electronics guy about logic, microprocessors and stored programs. You're idea is good, but you're too early — too early. If you can eat the losses for two years, OK, but it's going to be tough sledding. Anyway, you're a hard head — you enjoy the invitation to fail — that's the way we all got where we are. *73*, when it started, was pretty shaky, too.

Last thought: Why in the world would QST want to go to an 8½x11 format? It boggles the mind.

Thanks for hearing me out, Wayne. You may be an S.O.B., but you're my kind of S.O.B. Keep plunging.

David R. Halliburton WA3ZOR
726 Tiffany Court
Gaithersburg MD 20760

ROTATING

Your most attractive July cover is even more interesting if one rotates it clockwise 90° and then views it in a mirror. One can make out Saudi Arabia, the Red Sea, Gulf of Aden and the east coast of Africa, including the Nile River. Even the island of Madagascar is visible in the lower central portion of the picture.

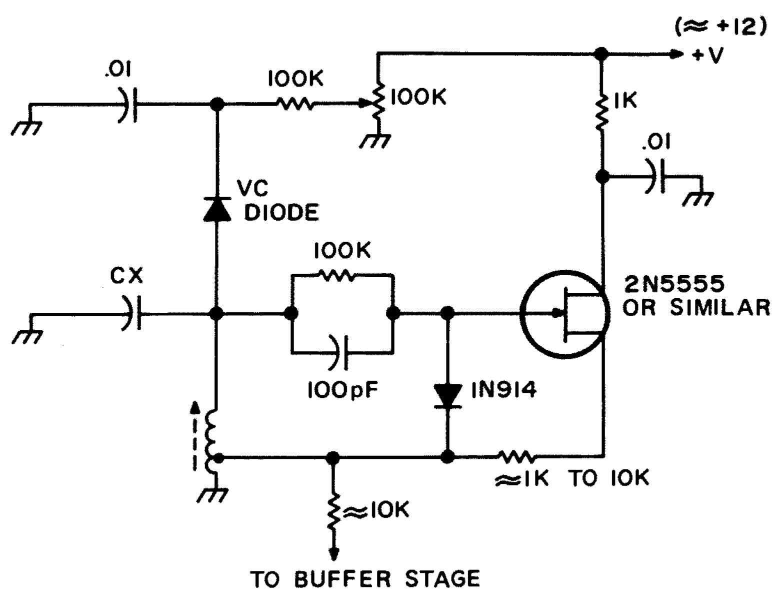
Lloyd Ferns VE3BZF
Orangeville, Ontario

GOOD-BYE Q-STREET

After receiving a bargain rate offer to subscribe to 73, and get a nifty code practice tape to boot, I decided to once again get a ham magazine. After only two issues, I am hooked. Your special July Oscar issue was long overdue. After reading it, I finally had all the info I needed in order to get started, and I hope to be on soon.

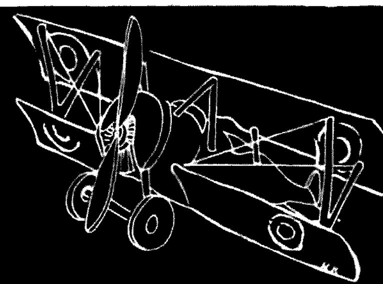
I quit subscribing to Q-Street because most of the articles were geared toward only those with degrees in engineering. (Besides, your covers are better!) So congrats on an FB publication — I'm eagerly awaiting the next issue!

Jeff Kline WA1RFF
Sharon MA



Autobiography of an Ancient Aviator

W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230



GOOD BYE KELLY HELLO BROOKLYN

Graduation from the Air Service Advanced Flying School was on December 17, 1922. Forty-one cadets from the combined classes received their "Airplane Pilot" rating and their A.P. wings. All were commissioned 2nd Lieutenants in the Air Service Reserve Corps. All except myself had to buy officer's uniforms. Fortunately, I was able to have my father send me my WW1 uniform so all I had to do was to replace the Infantry Collar insignia with the Air Service prop and wings and pin my A.P. wings above my WW1 medal.

Lt. Chauncy asked Munson and I if we would mind staying over a couple of days to do an artillery adjustment mission that had been requested for December 19th. We agreed, if he would arrange a lift to Dallas for me on the 20th. (Better train service to New York out of Dallas.) We spent half a day near Fredericksburg telling an artillery battery what poor shots

We spent half a day . . . telling an artillery battery what poor shots they were. They had no anti-aircraft guns so we were safe.

they were. They had no anti-aircraft guns so we were safe.

Along in late October Cleo and Wayne had moved from her parents' farm in N.H. back to their home in Brooklyn, N.Y. I arrived there on December 23rd, just in time to put up and decorate the Christmas tree. Wayne was almost four months old. He had grown quite a bit since I had seen him in September. However, he was still small enough to fit nicely in the temporary crib Cleo had made for him out of a bureau drawer with a pillow in it for a mattress. We had a marvelous Christmas — our first together.

A few days after Christmas I went out to Curtiss Field, near Garden City, Long Island, to see if any flying job was available. I talked with Casey Jones and he said he had nothing available but suggested that I go over to Heller Field in Newark, where an outfit called Federal Aviation had a hangar full of boxed LWF planes. He said he understood that they were assembling them for sale and that possibly one of their customers might want a pilot. Mitchel Field was nearby so I went over there to check in with operations for some army reserve flying.

Next day I went over to Newark and found my way out to Heller Field. Sure enough there was the hangar and I found Mr. Gillespie and his son in a lean-to with a potbelly stove going to keep the place livable. Yes, they owned the crated LWFs in the hangar but had no definite orders with deposits at that time. However, they had several warm prospects and were going to assemble a ship for display and would need some help for that. They explained that LWF stood for laminated wood fuselage (not loose, wobbly and frail as some people thought). The LWFs were originally equipped with a Sturtevant engine that was supposed to put out 200 horsepower. However, these engines had so thoroughly demonstrated their unreliability that Federal was junking them and installing 220 HP Hissos instead. (There is some question as to which of the two was more unreliable.) Gillespie said there was no problem in getting 220 Hissos if you had a case of whiskey to trade at a nearby Air Service depot. They offered me $8 a day to help assemble the ship. Since my transportation to and from Brooklyn and lunch would be only $1 a day, I told them I'd be there the next morning with my coveralls.

It took us until late February to assemble the plane. We had to remove the Sturtevant engine and install new hickory engine bearers. Then we got the new Hisso engine, cleaned the cosmoline preservative off it and installed it in the ship. We had to remove all controls from the front cockpit and cut away the fuselage to make seats for four (midgets). This, together with some soft places in the laminated wood fuselage (a result of rain water from a leaky roof), made it advisable to reinforce said fuselage. This was taken care of by bolting a two by four on each side of the fuselage all the way from nose to tail. Well, it looked like an airplane, anyway.

There was no such thing as flight testing the plane from Heller Field. It may have been a flying field at one time but by 1923 there was barely enough cleared field to take off with no passengers and only enough gas to get to Newark Airport. There was no coming back into Heller, so the ship had to be rigged accurately enough to enable the pilot to get it to a larger field and land it.

By the end of February the LWF was finished but still not sold, so I got a part time job selling Hupmobiles in Brooklyn on salary and commission.

As a reserve officer I was able to get enough flying time in Jennies and DHs

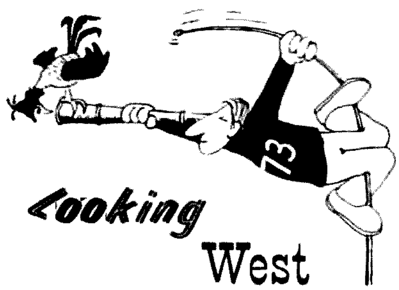
Gillespie said there was no problem in getting 220 Hissos if you had a case of whiskey to trade at a nearby Air Service depot.

to keep my "hand in" at Mitchel Field, Long Island. I'd get out there almost every week and put in an hour or so.

Around the middle of July, Gillespie phoned and told me that the ship we had put together was sold to Hal Bazley of Everett, Mass. Delivery was to be at the East Boston airport and would I be interested in flying it up there? I had just finished a two week tour of active duty at Mitchel so I had some catching up to do on my Hupmobile prospect list. Gillespie offered $150 plus expenses for the job so I told him I'd be over on July 27th to take the ship out of Heller.

On July 27th we gave the ship a final check and put ten gallons of gas in the tank. I got over the wires at the end of the field by about ten feet on my way to what is now Newark Airport. The ship handled very well with only a few minor adjustments to be made at Newark the next day. On the 30th I took the ship over to Mitchel and let some of the fellows over there look at it and shiver. Then on the 31st I flew her to Boston in two hours and forty-five minutes. Hal Bazley was there to meet me and take over ownership. I came back to New York that night on the "Old Fall River Line".

Next month I'll give you an account of my first experiences with an underpowered seaplane and with a Curtiss R4.



Looking West

Repeater Temps Rising in 'Hot' SoCal

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

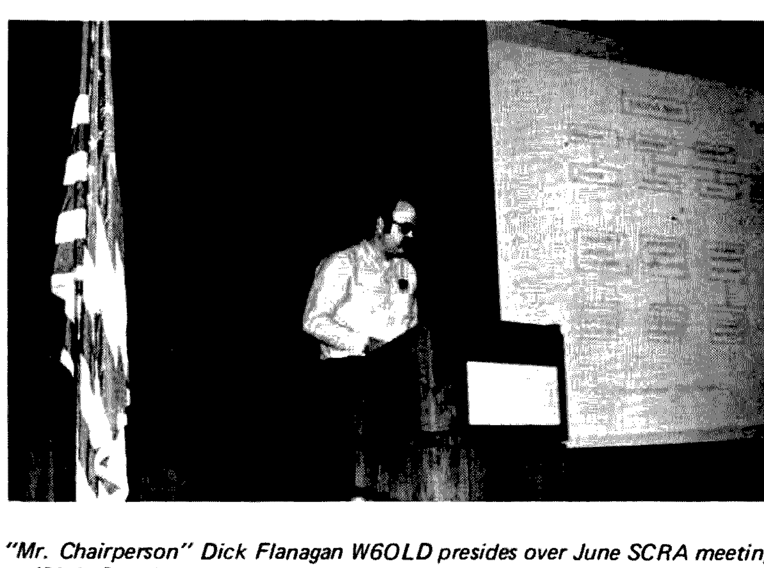
Let's begin this month's report by clearing the air as to what you are about to read; it will be, I hope, as objective a report as is possible on a rather controversial subject: that of the confrontation between proponents of repeaters and their counterparts favoring simplex operation on 146.76 MHz. To begin, a look back is definitely in order. If one is a traditionalist, and believes that the past must govern the future, then there is no question that "squatters' rights" prevail and that 146.76 must be reserved for simplex operation in the Los Angeles area. The many inhabitants of .76 simplex trace their heritage on that channel back to the late 1950s when they were just about the only occupants of what is today the repeater sub-band. As I understand the story, during the late fifties and early sixties the "in" channel was 146.755, due to the fact that everyone had the same surplus crystal. It was in the early sixties, and no one is quite sure as to why a move was made, that everyone QSYed up to .76 — and they have remained there ever since. Most, though not all, of the .76 simplexers live in the San Fernando Valley area, slightly northwest of L.A. proper.

While most stories have two sides, this one is rather unique in that it has four: that of the simplex inhabitants of .76, that of the Southern California Repeater Association, and that of the two repeaters accused by the simplex users of causing interference to .76 (WR6AJL, Mt. Laguna, in San Diego and WR6AFX on Table Mountain in the Antelope Valley area). As to the latter, WR6AFX, by far they have shown the most cooperation in this matter to date. As I stated in an earlier column filed in very early April, at that time I had yet to hear any signal from WR6AJL while at this QTH WR6AFX was definitely audible. Though I am not a .76 user, I do happen to live right smack in the middle of the San Fernando Valley and therefore decided to monitor the entire situation for myself.

There were two reasons for this. First, when tempers are running high, I tend to take much of what is told me with the proverbial grain of salt. The thought always goes through my mind at these times, "Wouldn't Joe Blow just love to convince me that he was right and the rest of the world was wrong and then make use of this column to plead his case to the nation?" The day I let that happen is the day when Wayne has my permission and support to pull this column from publication, and that gives you the second reason, to report one must deal in facts and supportable evidence — not heresay and innuendo.

While things grew worse to the south, the people responsible for WR6AFX, working with members of the SCRA Technical Committee, found that by re-orienting their antenna system most if not all of their signal leaking into the San Fernando Valley could be eliminated. At least in the eyes of the non-repeater simplex operators, WR6AFX was no longer a source of interference to them. If you don't mind my digressing for a moment, I wish to publicly express my appreciation in the name of the Southern California amateur radio community to WR6AFX, its owners and its users, for proving that the concept of mutual cooperation can and does work. As your editor noted in an earlier column, WR6AFX provides a rather invaluable service to those traveling the desert route between L.A. and points east.

During the time that a solution to the AFX vs. .76 simplex problem was being found, the SCRA was also trying hard to solve the Mt. Laguna issue. WR6AJL, Mt. Laguna, was operating under a 90 day temporary SCRA sanction and had specifically stated that its purpose was to provide desert coverage east from San Diego toward Yuma, Arizona. On countless occasions the San Diego Repeater Association (SANDRA) stated publicly that its purpose in erecting AJL was to provide open radio relay coverage to the aforementioned desert area and to Imperial County and that they, SANDRA, would take whatever steps were necessary to insure that there would be no interference to any Los Angeles operations. As early as



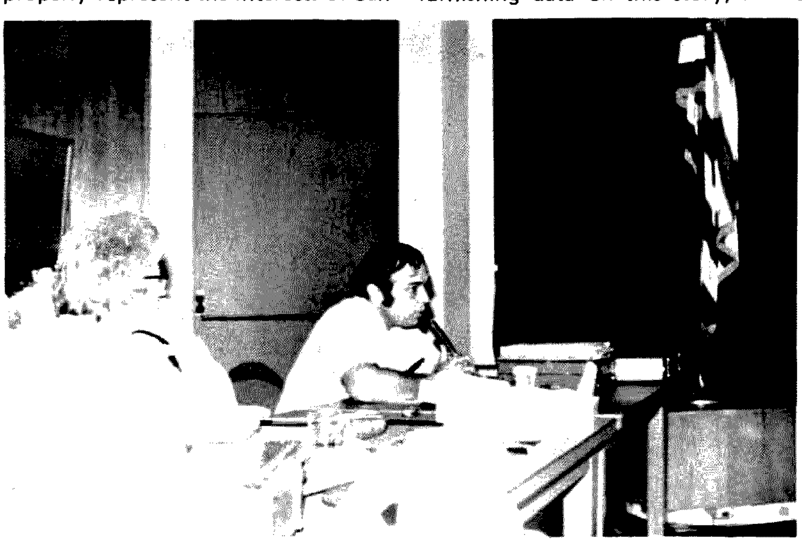
"Mr. Chairperson" Dick Flanagan W6OLD presides over June SCRA meeting at JPL in Pasadena.

October 1974, in meeting notes published in SANDRA's *Squelch Tales* newsletter, in discussing the merits of a .16/.76 repeater, it was stated as point #8 on page 17 of that publication that, "Our repeater should not interfere with Los Angeles, since our antenna will be east-west." In the monthly listing of SANDRA-sponsored repeaters appearing in *Squelch Tales,* WR6AJL is listed as "desert coverage". Yet WR6AJL, sitting atop an 8000' mountain, utilizes a Stationmaster antenna with a 3 degree downtilt that effectively aims it at the "radio horizon" in a 360 degree pattern. The radio horizon to the north for Mt. Laguna is Los Angeles!

SANDRA claimed and continues to claim that it has done and will continue to do all that is possible to eliminate the problem; however, it is evident that their words don't at this time fully align with their deeds. At the June 21 SCRA General Membership Meeting, it was announced that due to what was felt to be a total lack of cooperation on the part of SANDRA officials to work with the Technical Committee in solving this ever-worsening problem, their failure to file the required 75 day operational test report to the SCRA Technical Committee, and on other documentable matters in regard to this situation, that the temporary authorization (sanction) for WR6AJL had been terminated as of June 17th and that they were being requested to cease operation at once. Rather than adhere to this decision of the SCRA, the representatives of SANDRA withdrew en masse from SCRA membership, stating that they felt SCRA did not properly represent the interests of San Diego area FMers, and that they would go it alone. It was also stated by SANDRA representatives that their reason for not filing the aforementioned 75 day test report was that, due to the installation of the new Stationmaster antenna, any data contained in the report (data gathered before the new antenna was erected) would be outdated. (Of note, the test report is a necessity according to SCRA rules regardless of what type of modifications are taking place during an initial test period. Data contained therein can always be updated by amending such a report at a later date.) Also of note, though I have made it known publicly that I am following developments in this matter for publication in this column, and while both the SCRA and the simplex users have been most cooperative in furnishing data on this story, I have yet to hear anything from the San Diego Repeater Association. That is all that is necessary to have their side of the story expressed from their viewpoint.

Table Mountain responds to Technical Committee report.

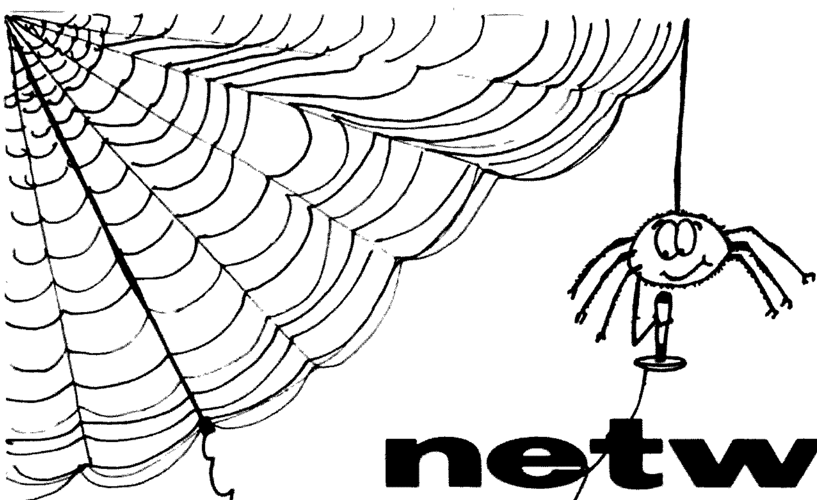
In the interim, WR6AKC, the Valley .76/.16 "in band talk back", a non-SCRA sanctioned or coordinated repeater, is busy at work locking up WR6AJL (or is it WR6AJL that is locking up WR6AKC?). Frankly, I don't give a damn which machine is doing what to which. I do care, however, about the loathsome creature who has apparently decided to expand this confrontation to include one of our local repeaters here in L.A.: WR6ABN. Of late, the "grunge" from .76 is appearing on the ABN .84 – .24 system and I guess the assumption must be made that due to the fact that ABN's owner supports the L.A. simplex activity, his repeater must be included in the confrontation. How utterly childish and asinine can people who are supposedly competent individuals and licensed amateur radio operators get? When will they ever learn that violence only breeds violence and that acting in such a crass manner can only bring the total wrath of both fellow amateurs and the FCC upon their heads? I for one want to know the individual responsible for this hideous act against the Southern California amateur radio community, so that he or they can be exposed to their peers for the sick malcontents that they are! If you want to fight over .76 then keep your fight on .76 or risk the wrath of your fellow hams nationwide – I will see to it that such is sent your way!



Skip Clark WB6TXX, SCRA Vice Chairman, responds to responses, as Sybil Albright W6GIC, SCRA Secretary and SANDRA Board Member, looks on.

Continued on page 162

E. H. Barnett WBØIIX
Route 1
Ashland, Missouri 65010



networks

Net Type
I — Information
R — Rag Chew
S — Service
T — Traffic

Note: Times and Days are given in GMT. Subtract one hour for nets changing time for Daylight Savings Time.

Service Area	*Net Type*	*Name*	*Time*	*Days*	*Freq*	*Mode*
INTERCONTINENTAL						
North & South America	T	Intercontinental Net	1200	Daily	14313	USB
North & South America	T	Americas Net	1800	Mon &Fri	14205	USB
North & South America	T	Intercontinental Net	2300	Daily	14313	USB
NATIONWIDE						
U.S.	S	Eyebank Net	0100	Daily	3970	LSB
U.S.	S	Eyeband Net	1200	Daily	3970	LSB
REGIONAL						
Gulf Coast U.S.	T	Gulf Coast SBN	2330	Daily	3925	LSB
East U.S.	S	ECARS	Cont.	Daily	7255	LSB
Midwest U.S.	S	MWARS	Cont.	Daily	7258	LSB
Southeast U.S.	R	Corncobbers	1130	Mon - Fri	7274	LSB
Mid U.S.	S	Recreational Vehicle Net	1130	Mon - Fri	7280	LSB
STATEWIDE						
NJ	T	NJ Net	0000	Daily	3695	CW
MO	T	Missouri SBN	0000	Tues - Sat	3963	LSB
IA	T	Iowa SBN	0000	Daily	3970	LSB
KS	T	Kansas SBN	1245	Mon - Sat	3920	LSB
IN	T	Indiana Traffic Net	1330	Daily	3910	LSB
FL	R	Florida QCWA Net	1700	Sun	7247	LSB
SC	T	SC Emergency Net	2300	Daily	3907	LSB
IN	T	Indiana Traffic Net	2300	Daily	3910	LSB
KY	T	Kentucky Traffic Net	2345	Daily	3955	LSB
OH	T	Ohio SBN	2345	Daily	3972	LSB

I need your help. There are only so many nets that I can discover for myself. Help me by telling me about nets that you know of. Just drop me a QSL stating: Name, Area served, Time (GMT), Days (GMT), Freq. & Mode.

from page 2

TIME TO SUBSCRIBE?

There is a lot to dislike about the larger size format for the ham magazines . . . and one of the worst aspects is that, despite what anyone says, it is a lot more expensive than the smaller magazines . . . and this means a higher cost to you.

The new cover price for 73 will be $1.50, starting with January, which comes out to $18 per year on the newsstands. The subscription price will go up, first to $10 a year . . . more later on. Add to this an extra $2 for a special secret giant bonus issue which is in the works and you will spend $20 on the newsstand for the yearl That makes the present $8 per year, $16 for three year rate look pretty good. These rates will hold until October 15th, then it's up they go. October 15th is the last minute for getting a subscription into the blasted computer system for the December issue . . . which is mailed in early November.

Over a three year period you save about $44 by spending $16 now.

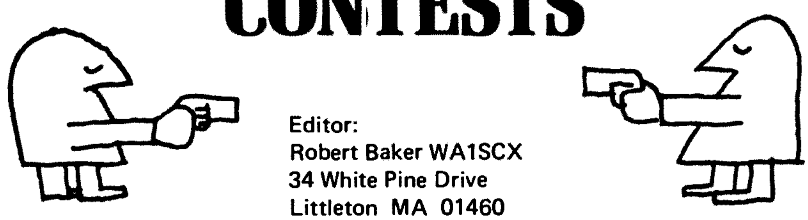
BOX SCORE

Readers might not notice, but advertisers and other publishers (particularly) notice little things like the number of pages in a magazine or the number of pages of ads in an issue. You've probably been vaguely aware that it takes longer to read 73 these days and it's a little heavier to prop up in bed.

During the last quarter the ad pages worked out like this . . .

Continued on page 168

CONTESTS



Editor:
Robert Baker WA1SCX
34 White Pine Drive
Littleton MA 01460

OHIO INTERSTATE QSO PARTY
1900 GMT Saturday
August 30 to 0300 GMT
Sunday, August 31
1500 GMT to 2300 GMT
Sunday, August 31

All amateurs are invited to participate in the Ohio Interstate QSO Party sponsored by the Ohio Council of Amateur Radio Clubs. There are no restrictions on operating time, power or number of operators or transmitters. Each station can be worked twice on each band: once on phone, and once on CW. Ohio stations may contact any other station for credit. Non-Ohio stations may contact only Ohio stations for credit. To encourage emergency preparedness and provide contacts from rare Ohio counties, portable stations operating from any Ohio county EXCEPT Butler, Cuyahoga, Franklin, Hamilton, Lorain, Lucas, Mahoning, Montgomery, Stark, Summit, and Trumbull may multiply their final score by 1.5. Portable operation is defined as operation outside the county in which you are licensed and signing your call as /8.

EXCHANGE:
Send QSO number, RS(T), and ARRL section or Ohio county. Stations operating on a county line may issue more than one multiplier, but not more than one QSO number, to an individual station per band per mode.

FREQUENCIES:
1805, 3575, 3975, 7075, 7275, 14075, 14285, 21075, 21375, 28075, 28575, 50.15, and 145.10. Try phone each even hour GMT and CW each odd hour GMT. Try 160 at 0200 GMT August 31.

SCORING:
QSO points are 1 per completed exchange on 80 through 10 meters, and 2 on 160 and all frequencies above 50 MHz. As a bonus, a complete exchange with the Ohio State Fair special event station is 5 QSO points on 80 through 10 meters. For Ohio stations, the final score is the total number of QSO points multiplied by the number of ARRL sections worked, including Ohio. DX stations may be worked for QSO points but do not count as additional sections. For all others, the number of QSO points is multiplied by the number of Ohio counties worked. Portable stations changing counties during the contest may repeat contacts for QSO points, but multiple contacts may not be claimed by operating on a county line. Stations outside Ohio may claim both QSO points and counties.

AWARDS:
First, second and third place awards will be given to the highest scoring stations inside and outside Ohio, and to the winners in each ARRL section and Ohio county, providing at least 10 different stations are contacted. Separate awards to stations using frequencies above 50 MHz exclusively.

LOGS
Logs showing time, date, stations contacted, QSO exchange, band, mode, location and score must be received by November 1, 1975, by: OHIO QSO Party, 6470 Penick Drive, Reynoldsburg OH 43068. Contest package of log, Ohio County and ARRL section list, and summary sheet will be sent by the OHIO QSO Party upon receipt of SASE.

EUROPEAN DX CONTEST
– PHONE
Starts: 0000 GMT Saturday,
September 13
Ends: 2400 GMT Sunday,
September 14

DARC is sponsoring the 21st annual European DX Contest this year. Use all bands, 80 to 10 meters. Only 36 hours of the 48 hour contest period may be used by single operator stations. The 12 hour rest period may be taken in one but not more than 3 periods, anytime during the contest. Single operator-All Band and Multi-operator Single transmitter are the only 2 classes.

EXCHANGE:
Five or six digit number, RS(T), QSO Number (start at 001).

SCORING:
One point per QSO and one point for each QTC reported.

MULTIPLIERS:
Multiplier for Non-Europeans is number of EU stations worked on each band. Europeans will use ARRL list and call areas: JA, PY, VE/VO, VK, W/K, ZL, ZS and UA9/UAØ. In addition, the multiplier on 80 meters may be multiplied by 4, on 40 meters by 3, and on 20 to 10 meters by 2.

FINAL SCORE:
Final score equals total QSO points plus QTC points, times the sum total multiplier from all bands.

QTC – TRAFFIC:
Additional QSO point credit may be realized by reporting a QTC. This is a report of a QSO you have made earlier in the contest and later sent back to an EU station. One point is earned for each QSO reported. A QTC can only be sent from a non-EU to an EU station. A QTC contains the time, call and QSO number of the station being reported. Example: 1432 – G4JZ – 157. It may be reported only once and not back to the originating station. A maximum of 10 QTCs are permitted to the same station, and the same station may be worked several times to complete this quota. However, the original QSO is all that may be counted toward QSO points. Try to keep a uniform list of QTCs sent. QTC 4/6 indicates that this is the 4th series with 6 QSOs now being sent.

AWARDS:
Certificates will be awarded to the highest scorers in each country and call area listed above. Continental leaders, and stations having at least half the score of the continental leader, will also be awarded certificates.

DISQUALIFICATIONS:
Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts or multipliers will be deemed cause for disqualification. Decision of the Contest Committee is final.

LOGS:
It is suggested that you use the official DARC log and summary forms. An SASE with sufficient postage or IRCs should be sent to the Contest Committee (or to W1WY or WA3KWD for W/K and VE stations). If making your own logs, use 40 contacts to the page and use a separate sheet for each band. Mailing deadline for logs is October 15, 1975, to the WAEDC Contest Committee, D-895 Kaufbeuren, P.O. Box 262, West Germany.

EUROPEAN COUNTRY LIST:
C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HBØ, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OHØ, OJØ, OK, ON, OY, OZ, PA, SM, SP, SV, SV Crete, SV Rhodes, SV Athos, TA1, TF, UA1-3-6, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, ZB2, 3A, 4U1, 9H1.

PENNSYLVANIA QSO PARTY

Operating Periods:
1600 to 2100 GMT Saturday, September 13
2300 GMT Sat., Sept. 13 to 0500 GMT Sun., Sept. 14
1300 to 2400 GMT Sunday, September 14

All amateurs are invited to participate in the 18th annual Pennsylvania QSO Party sponsored by the Nittany Amateur Radio Club. Pennsylvania stations may work both in-state and out-of-state stations.

EXCHANGE:
Send QSO number, RS(T), and PA county or ARRL section.

FREQUENCIES:
1810, 3560, 7060, 14060, 21060, 28060, 1815, 3980, 7280, 14315, 21380, 28560. Novice: 3715, 7160, 21115, 28115. Try phone on EVEN hours, 160 meters at 0300, and 10 meters at 1900 GMT.

SCORING:
Pennsylvania stations score 3 points per out-of-state QSO, 1 point for PA QSOs multiplied by the number of ARRL sections worked (EPA & WPA may be counted as sections). All others score 1 point per QSO times the total number of PA counties worked. Stations may be worked once on each CW band and once on each phone band. A bonus of 100 points is offered to each mobile for each county activated during the contest.

LOGS:
Send log and summary sheet including number of QSOs, total number of counties or sections, QSO points, final claimed score, rig description, number of hours operated, comments, gripes, and suggestions by October 15, 1975 to: W3HDH, Douglas Maddox, 1187 S. Garner Street, State College PA 16801. Results will appear in the January issue of the Nittany Amateur Radio Club Newsletter, which will be mailed to all entrants.

YL HOWDY DAYS CONTEST

Starts: 1800 GMT Wednesday, September 17
Ends: 1800 GMT Friday, September 18

Only contacts with licensed women operators count. All bands and modes of emission may be used. No cross-band operation and net contacts do not count. Only one contact with each station will be counted.

SCORING:
Score two points for each YLRL member worked and one point for each non-YLRL member worked. There are no multipliers.

AWARDS:
Top scoring YLRL member will receive her choice of a YLRL pin, charm, or stationery. Non-YLRL member will receive a one year membership in YLRL.

LOGS:
Logs must be received no later than October 19, 1975 by Mrs. Myrtle Cunningham WA6ISY, 1105 East Acacia Avenue, El Segundo CA 90245.

DELTA QSO PARTY

Starts: 2000 GMT Saturday, September 27
Ends: 0200 GMT Monday, September 29

The sixth annual Delta QSO Party is sponsored by the Delta Division of the ARRL and all amateurs are invited to participate. There are no operating or power restrictions. Amateurs outside of the Delta Division will attempt to contact as many amateurs inside of the Delta Division (Ark — La — Miss — Tenn) as possible. Delta Division stations will attempt to contact as many amateurs as possible both inside of and outside of the Delta Division. The general call will be "CQ Delta QSO Party" on SSB and "CQ Delta" or "CQ Test" on CW.

EXCHANGE:
Send QSO number, RS(T), and QTH (ARRL section for non-Delta Division stations — county and state for Delta Division stations). Portables and mobiles may be reworked on the same band/mode if they change counties.

FREQUENCIES:
CW: 3550, 7050, 14050, 21050, 28050. SSB: 3990, 7290, 14290, 21390, 28590. Novice: 3725, 7125, 21125, 28125.

SCORING:
Delta Division — number of QSOs times the number of ARRL sections (max. 75) equals final score. Outside Division, number of QSOs times the number of counties worked (max.

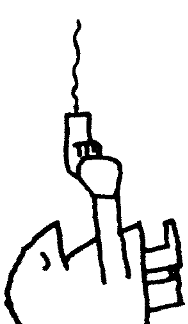
Continued on page 166

CONTEST CALENDAR

Aug 30-31	Ohio Interstate QSO Party	Oct 11-12	CD Party – Phone
Sept 6-7	ARRL VHF QSO Party	Oct 11-12	VK/ZL/Oceania CW
Sept 6-7	Savaria CCS Contest	Oct 15-16	YL Anniversary Party – CW
Sept 6-8	Four Land QSO Party*	Oct 18-19	CD Party – CW
Sept 6-8	Maryland/D.C. QSO Party	Oct 19-20	Manitoba QSO Party
Sept 7	Tu-Boro RC 2m RTTY Contest	Oct 25-26	CW WW DX Phone Contest
Sept 13-14	CLARA Day Contest	Nov 1-3	North Carolina QSO Party
Sept 13-14	European DX Contest – Phone	Nov 6-7	YL Anniversary Party – Phone
Sept 13-14	Pennsylvania QSO Party	Nov 7-10	IARS/CHC/FHC/SWL-CHC/HTH QSO Party
Sept 13-15	Washington State QSO Party*		
Sept 17-19	YL Howdy Days	Nov 8-9	European RTTY Contest
Sept 20-21	Scandinavian CW Contest	Nov 8-9	ARRL Sweepstakes – CW
Sept 20-21	VE/W Contest	Nov 22-23	ARRL Sweepstakes – Phone
Sept 27-28	Scandinavian Phone Contest	Nov 29-30	CQ WW DX CW Contest
Sept 27-29	Delta QSO Party	Dec 6-7	160 Meter Contest
Oct 1-Nov 30	RTTY Art Contest	Dec 6-7	TOPS CW Contest
Oct 4-5	California QSO Party	Dec 13-14	10 Meter Contest
Oct 4-5	Rocky Mountain QSO Party	Dec 31	Straight Key Night
Oct 4-5	VK/ZL/Oceania Phone		

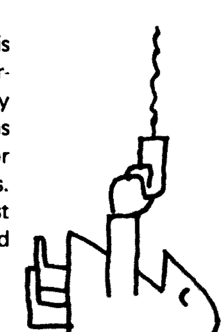
* = described in previous issue.

SPECIAL REQUEST



Now that this contest calendar is underway, I will attempt to list information each month on as many different contests and special events as I can. I will also be listing results for various contests, as space permits. Please send all information on contest announcements, special events, and results directly to me:

Robert Baker WA1SCX
34 White Pine Drive
Littleton MA 01460 USA



Caveat Emptor?

PRICE — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

WANTED — Make, Model and Serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma WA 98466.

NEW VHF Engineering RPT 144-Kit for sale first $300 takes it. (I won it at Dayton) 419 447-2212 or R. Wright, 185 South Washington, Tiffin OH 44883.

HEATHKIT SB-303 receiver, very good condition, no modifications. Factory-aligned and includes CW filter. $275 or best offer. Kurt Nilles, 115 Nevada, Dubuque IA 52001.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945-75. Indispensable!)

CINCINNATI HAMFEST: 38th annual — Sunday, September 21, 1975 at the New Stricker's Grove on State Route 128, one mile west of Ross (Venice), Ohio. Flea market, contests, model aircraft flying, food and beverages all day. Advanced tickets $7.00, covers everything; $8 at gate. For tickets or further information: Carl J. Dettmar W8NCV, 8630 Cavalier Drive, Cincinnati OH 45231.

CLEANING SHACK — HW-101, Gonset Communicators, Old QST, 73 and CQ, many more goodies. Send SASE for list. K8ILR, 257 National NW, Grand Rapids MI 49504.

FREE: 8 EXTRA CRYSTALS of your choice with the purchase of a new ICOM IC-22A at $249. With the 10 crystals which come factory installed in the IC-22A, this gives you a total of 18 crystals! For equally good deals on Kenwood, Drake, Collins, Ten-Tec, Swan, Atlas, Midland, Standard, Regency, Tempo, Alpha, Genave, Hy-Gain, CushCraft, Antenna Specialists, Hustler, Mosley, and others, write or call HOOSIER ELECTRONICS, your ham headquarters in the heart of the Midwest, and become one of our many happy and satisfied customers. HOOSIER ELECTRONICS, P.O. Box 2001, Terre Haute, Indiana 47802. (812) 894-2397.

HP-65 USERS exchange ideas, programs, methods. Monthly newsletter. Request information and sample newsletter. Richard Nelson, 2541 W. Camden Pl, Santa Ana CA 92704.

HEATH SB-301, SB-401, factory aligned. Motorola 6/12 V 2-meter mobile (T43GGV-5) all w/manuals, extras. Make offers. Charlie Wood, 1963 Douglas Dr., Tawas City, Mich., 48763.

SWAN 250C, 6-meter transceiver with P/S speaker, remote VFO, noise blanker & TV2D 2-meter transverter. Mint condition. K3IPM 215 355-2867.

CRUNCHER!! 300 Watts output on 2 meter FM. Motorola AM-494/GR amplifier with T43 transceiver and supplies. Offers? Trades? W9HAJ, 1200 Arundel, Kokomo, Ind. 46901. (317) 452-8971.

FREE BARGAIN CATALOG. LEDs, Xtals, Microphones, Headsets, ICs, Relays, Ultrasonic Devices, Precision Trimmer Capacitors, Unique Components. Low, Low Prices! Chaney's, Box 15431, Lakewood, Colo. 80215.

COLLINS: 30S-1 2KW amplifier excellent operating and physical condition, trade for Bendix R-1051B/E receiver same condition. Sid Sidman, 3571 Gresham Court, Pleasanton, California 94566.

HW-12 $90; HW-22 $95; HP-13 P. supply $45; SR42 $60; BC-221 $35; TS-175 $60; "LDS" mobile ant $18; F.O.B. Yoakum, Texas 77995, K5QJS.

AMAZING, NEW, UNIQUE, EASY, method of mastering the Morse Code. Fully guaranteed. Send $5.95 to GENERAL, Dept-978, Box 137, Northridge CA 91324.

SELL: G.E. Voice Commander on 31-91. New case, spare nicad pack, charger. Best offer over $50.00. P. Smith WB9JSE, 7723 W. Bender Ave., Milwaukee WI 53218.

MEMPHIS is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, on Saturday and Sunday October 4 and 5. Demonstrations, displays, MARS meetings, flea market, XYL entertainment, prizes. Informal dinners Saturday night. Dealers and distributors welcome. Talk-in on 3980, .34-.94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis TN 38127 or telephone (901) 358-5707.

COLLINS 30S-1, excellent, new 4CX-1000A, $1050, alpha 374, brand new, in warranty $975, Techtronics 310A with cart $250. Sid Sidman, 3571 Gresham Ct., Pleasanton, Calif. 94566.

VIDICON 7038 — $15.00; 7262A — $15.00; 8844 — $20.00; Peterson 50 MHz Scanner — $25.00. WB2GKF, Stan Nazimek, 506 Mount Prospect Avenue; Clifton, New Jersey 07012.

WALL TO WALL Drake R4-A, T4-X, AC-3, and MS-4 $675 postpaid USA, KG4CB, Satellite Communications Detachment, FPO New York NY 09593.

MOTORHOME for sale. 25 ft. Sportscoach (RB) — 1973 — excellent condition — many extras. Antennas — 2 mtr. TV, (2) HF — 4 KW generator, sleeps six. $1,500 down, assume loan. Send SASE for more info. W6KHS, 212 Magellan St., Capitola CA 95010.

MOTOROLA TWIN V: Like new, gray wrinkle finish case, output meter built-in, power supply permits use on 110VAC, 12VDC or 6VDC. 2 meter transceiver has 16/76, 22/82, 94/94. Was asking $165.00, will take $135.00. First cashier's check gets shipment same day. M. T. Henry, 5173 North Hampton Ridge, Norcross, Georgia 30071.

Continued on page 170

AMSAT CONSIDERING SHORT-LIFE HF SATELLITE

While work is progressing on a near synchronous VHF long-life satellite, AMSAT is considering a low orbiting (225 nautical miles) high frequency satellite. Basically, AMSAT would supply the command and control equipment for a bicentennial satellite which would feature a zero order magnitude flashing light prepared by the Brevard County, Florida, Bicentennial Commission. The light would be in operation July 4, 1976. Because a low orbit is necessary for the light, a VHF translator would be impractical. Tentative plans call for a translator with an input on 21.2 to 21.3 MHz and a ten meter output.

Availability in July, 1976 necessitates a March, 1976 launch, leaving precious little time for circuit development; however, it is hoped that this satellite will act as a proving ground for several sections of the next complex VHF satellite. To meet this goal, several new projects have begun, including an analog telemetry unit under design by W1GBO.

AMSAT-OSCAR 7 HAS A MIND OF ITS OWN

Occasionally Oscar 7 switches modes by itself. This causes considerable work for the command stations, as it is then necessary to reset the satellite into the correct mode and insure the internal 24 hour clock will switch modes at 0000Z.

If you are waiting to acquire the satellite's downlink and it is late, check the other downlink. You could find yourself in the enviable situation of being one of only two or three stations on the satellite. This situation provides armchair copy QSOs. If you should observe a mode switch, it would be appreciated at AMSAT if you note the time, orbit number and other pertinent conditions that might help AMSAT determine the cause of this phenomenon.

OSCAR 6 BATTERIES DROP TO LOW VOLTAGE

As the satellite sees the sun for the smallest period of its orbit during June, the battery voltage on Oscar 6 dropped dangerously low just before Field Day activities. To insure that Oscar 6 would be operational for all of Field Day, it was turned off several days prior to the event. As the summer wears on, each day the satellite will see more and more energy-giving sunlight, until the maximum sunlight per orbit is reached in February.

UNEXPLAINED NOISE REMAINS ON OSCAR 7 MODE B OUTPUT

Although the Oscar 7 Mode B translator (432.150 to 145.950) is functioning well, occasionally unexplained noise is transmitted to the ground in sections of the passband on two meters. Because the noise comes and goes during different parts of the orbit, this phenomenon has been difficult to identify with any specific cause. AMSAT welcomes your comments and observations as to the cause of the noise, as well as any data you might have which substantiates your conclusions (such as correlation to radars, solar activity, aurora, magnetic storms, etc). Write AMSAT, Box 27, Washington DC 20044.

OSCAR SLIDE SETS AVAILABLE

K6PGX is offering a set of 21 slides, which includes a photo of the launch of Oscar 7, for S5.40 postpaid. His address is Norman Chalfin K6PGX, PO Box 463, Pasadena CA 91102. All proceeds go to AMSAT and help build future satellites.

Oscar 6 Orbital Information

Orbit	Date (Sept)	Time (GMT)	Longitude of Eq. Crossing °W
13153	1	0113.5	69.1
13165	2	0013.4	54.1
13178	3	0108.4	67.8
13190	4	0008.3	52.8
13203	5	0103.2	66.5
13215	6	0003.2	51.5
13228	7	0058.1	65.2
13241	8	0153.0	79.0
13253	9	0052.9	64.0
13266	10	0147.9	77.7
13278	11	0047.8	62.7
13291	12	0142.7	76.4
13303	13	0042.7	61.4
13316	14	0137.6	75.2
13328	15	0037.5	60.1
13341	16	0132.5	73.9
13353	17	0032.4	58.9
13366	18	0127.3	72.6
13378	19	0027.3	57.6
13391	20	0122.2	71.3
13403	21	0022.1	56.3
13416	22	0117.1	70.1
13428	23	0017.0	55.0
13441	24	0111.9	68.8
13453	25	0011.9	53.8
13466	26	0106.8	67.5
13478	27	0006.7	52.5
13491	28	0101.7	66.2
13503	29	0001.6	51.2
13516	30	0056.5	65.0

Oscar 7 Orbital Information

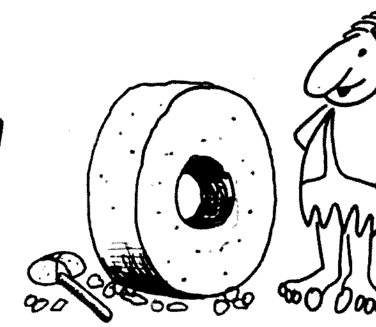
Mode	Orbit	Date (Sept)	Time (GMT)	Longitude of Eq. Crossing °W
B	3625	1	0056.6	64.0
A	3638	2	0150.9	77.6
BX	3650	3	0050.3	62.4
A	3663	4	0144.5	76.0
B	3675	5	0043.9	60.8
A	3688	6	0138.2	74.4
B	3700	7	0037.5	59.2
A	3713	8	0131.8	72.8
B	3725	9	0031.1	57.6
AX	3738	10	0125.4	71.2
B	3750	11	0024.8	56.0
A	3763	12	0119.0	69.6
B	3775	13	0018.4	54.4
A	3788	14	0112.7	68.0
B	3800	15	0012.0	52.8
A	3813	16	0106.3	66.4
BX	3825	17	0005.6	51.2
A	3838	18	0059.9	64.8
B	3851	19	0154.2	78.4
A	3863	20	0053.5	63.2
B	3876	21	0147.8	76.8
A	3888	22	0047.2	61.6
B	3901	23	0141.4	75.2
AX	3913	24	0040.8	60.0
B	3926	25	0135.1	73.6
A	3938	26	0034.4	58.4
B	3951	27	0128.7	72.0
A	3963	28	0028.0	56.8
B	3976	29	0122.3	70.4
A	3988	30	0021.7	55.2

amsat

Gary Tater W3HUC, 7925 Nottingham Way, Ellicott City MD 21043

TM

NEW PRODUCTS



The New Clegg

Clegg's response to the encroaching competition is to give more — a lot more. This may be a winning philosophy.

With the filling up of the 146-148 MHz bands, there is more and more interest in being able to flip down below 146 for simplex operation — with the Clegg FMDX you can do this, for it not only covers the two meg repeater band, but also the MARS bands on either end of the two meter ham band — and the MARS chaps have been setting up repeaters too, you know. The FMDX will take you from 143.5 to 148.5 MHz, giving you just about everything you could ask for, including both high and low MARS bands, CAP, the DX part of 2m, and even the Oscar band.

If you are into repeaters at all, and the odds are that you are since over 50% of the active amateurs are using 2m at least part of the time today, you've probably wanted to be able to call in on all of the repeaters in your area . . . and perhaps all those in areas you may visit. This means today that you must be able to have a good deal of flexibility, and it certainly means synthesis. The growing number of "splinter" channel repeaters . . . using the 15 kHz splits . . . has created some problems for early synthesized rig owners where it takes special crystals to hit these channels, and the front panel readout is, to be kind, cryptic. The FMDX covers every 5 kHz of the band, thus giving you all of the splinter repeaters . . . and it will permit you to work those which are avoiding the interference from adjacent channels by being on reversed pairs.

The Clegg system for setting frequency is simple and effective. There is one rotary switch for the megahertz, one for the 100 kHz, one for 10 kHz and a +5 kHz bat handle switch. The readout is like a frequency counter — bright red LEDs indicating the receive or transmit channel. The readout is large enough so you can read it at a glance while driving — this is one of the easiest rigs yet for mobile use.

The FMDX is set up for 600 kHz splits, but if you have a weirdo in your area with 990 kHz or 1 meg split you can adapt to it by buying a crystal for the new split. The FMDX has a switch on the front panel to permit up to three different extra splits. There's a lot of that wide split stuff going around in New York.

While the chances are that you can do just fine with a ten Watt rig, the fact is that most repeaters run a good deal more than that and you need a little extra zap if you are going to get into downtown areas or out in the country in the valleys. The Clegg runs about 35 Watts output (with a switch for one Watt) and this does a good job of equalizing repeater coverage for you. With ten Watts you often find yourself dropping out and wish for a little more signal, but you may be reluctant to go the price of an amplifier . . . and they aren't cheap.

In operation, the Clegg is a dandy. There is none of the lock-up delay that one popular rig has, so you go from receive to transmit instantly. The receiver has enough power to drive your regular car loudspeaker if you like (plugs into the back and thus disables the built-in smaller speaker). The four pole i-f filter keeps the repeaters from coming in from adjacent channels. The mike gives you excellent quality reports (and some rigs are incredibly bad). The S-meter/power output indicator lights up for mobile use . . . and an S-meter is handy in that it gives you a good indication of how great your chances are of being heard by the repeater.

In order to keep the price on this fantastic package at a level where amateurs can afford it, Clegg has gone to factory-direct sales . . . and the FMDX is certainly an excellent buy at under $600. You can bet that there will be a lot of the Clegg FMDX units around very quickly.

LINEAR AMPLIFIERS

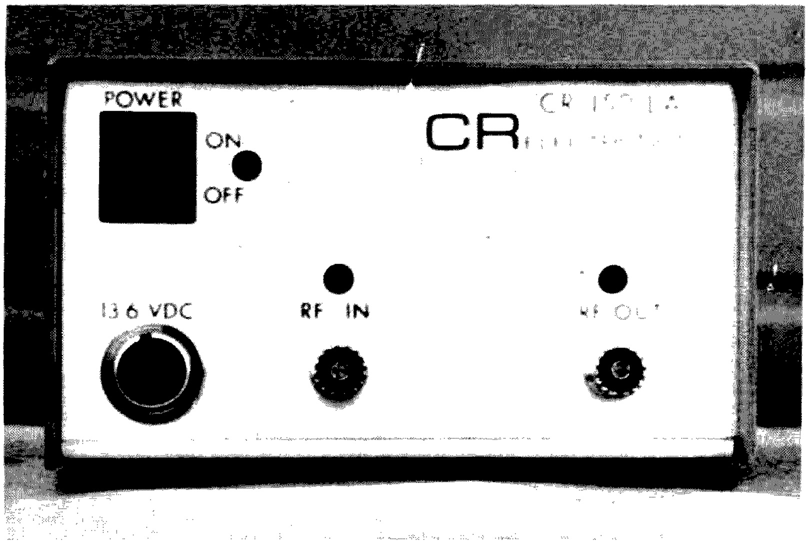
CR Electronics, in Foster City, California, has introduced their new series of linear amplifiers, which are fully solid state. Two models are available, the CR-150LA, 200 Watt PEP output and the CR-300LA, 400 Watt PEP output. These amplifiers have a frequency range of 1.6 to 30 MHz and they only require a 3-5 Watts drive. Both models are available for amateur use on 80, 40, 20, 15 and 10 meter bands.

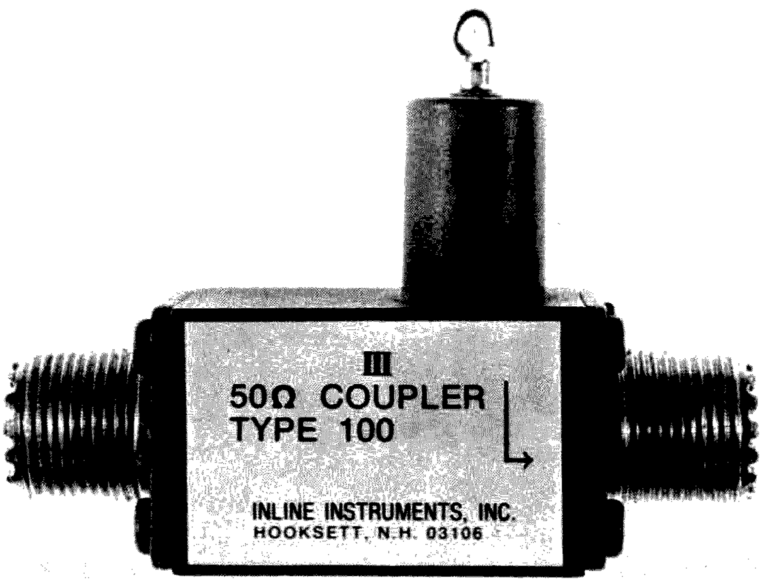
COAXIAL COUPLER POWERS ACCESSORIES VIA CABLE

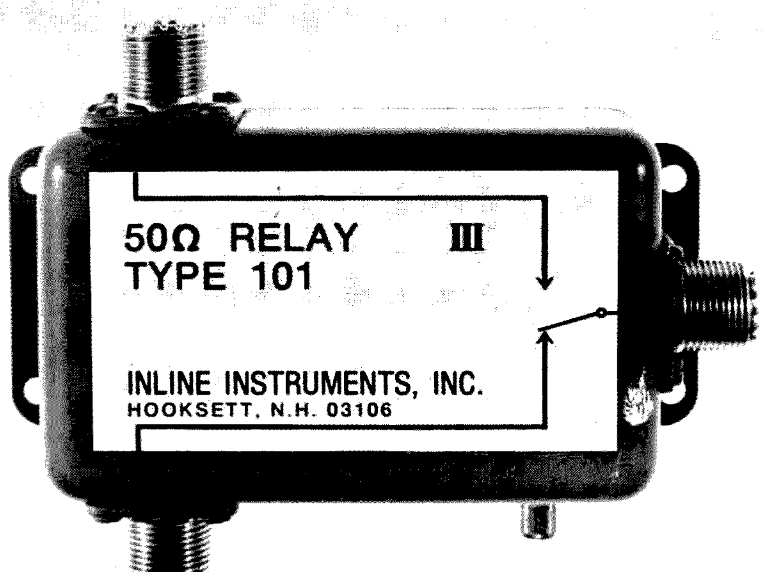
When installed inline on a coaxial cable, Inline Instrument's Type 100 Coupler allows relays, amplifiers, etc., to be powered via the signal cable. Ac, dc, or both simultaneously, may be injected locally and utilized remotely without affecting the original signal characteristics of the coaxial cable. Features include: multi-octave bandwidth; negligible swr and insertion loss; weatherproof construction; and no insertion noise. Two types cover the spectrum from medium frequency through UHF. Power capability is 250 W. Price $12.50. Write: Inline Instruments, Inc., Box 473, Hooksett NH 03106.

COAXIAL RELAY IS POWERED VIA SIGNAL CABLE

When used with a companion coupler, the coaxial relay derives its control power via the signal cable. Typically, it can be installed on a tower or pole to switch two antennas. Features include swr under 1.1, insertion loss under 1 dB, and weatherproof construction. Selectable control polarity permits multiple relays on a single coaxial line to change antenna patterns or rf loads. Frequency coverage is available from medium frequency through UHF. It will handle minus dBm levels to 150 W. Price $24.50. Write: Inline Instruments, Inc., Box 473, Hooksett NH 03106.







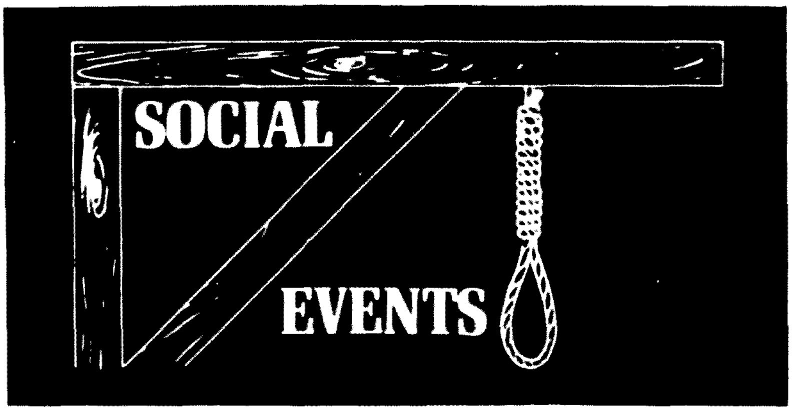
NEW LEADER 5" HORIZONTAL DUAL CHAN/DUAL TRACE SCOPE

The LBO-552 is a solid state dual channel/dual trace oscilloscope/ vectorscope which provides a simultaneous left/right wave form display to make general purpose measurements and audio testing easier than ever, according to the manufacturer, Leader Instruments Corp., Plainview NY.

This new 20 mVp-p/cm sensitivity dual channel instrument permits the user to view 2 independent signals simultaneously — and side by side on a bright CRT display. It provides 2 separate vertical gain controls for independent and joint operation and also features a single channel display for conventional testing. Vertical bandwidth is dc or 2 Hz to 1.5 MHz. Sweep speeds are from 10 Hz to 100 kHz in 4 ranges, with an input impedance of 1 mΩ shunted by 40 pF. Phase differences on the X-Y axis are below 2° at 20 kHz and below 8° at 100 kHz. Left/right channel accuracy level is ±3%.

Among its many uses, the LBO-552 is said to be ideal for inspecting and aligning sophisticated stereo equipment including amplifiers, receivers and tape recorders as well as car stereos. It is also useful for on-line production and quality control testing. It measures 9-5/8"H x 6-7/8"W x 15"D and weighs approximately 15.5 lbs. Selling for $399.95, it operates on 100, 115, 215 or 230 V power, as specified, 50/60 Hz; approximately 20 VA.

Continued on page 160



MONCTON NEW BRUNSWICK
AUG 29-SEPT 1

The Moncton Area Amateur Radio Club will sponsor the Atlantic Canada ARRL Amateur Radio Convention, August 29 – September 1, 1975 at the Hotel Beausejour, Moncton, New Brunswick. Exhibits, technical forums conducted by ARRL Headquarters personnel, VHF forum, swap shop, buffet Saturday night followed by dance, dinner and entertainment Sunday night, hidden transmitter hunt, etc. Talk-in on 146.28 – 88 and 146.52 simplex. For full information, write: Moncton Area Amateur Radio Club, P.O. Box 115, Moncton, N.B.

SAN FRANCISCO CA
AUG 29-SEPT 1

The Quarterly NORCAL DXers (Northern California DXers) gabfest will be held Labor Day weekend at the El Rancho Inn, 1100 El Camino Real, Millbrae CA 94030. $1 reg. at door. Emphasis on SWL DXing. Technical sessions, displays, quiz, auction and free refreshments. Door prizes. For more info write NORCAL, Rick Heald, 17412 Rolando Avenue, Castro Valley CA 94546.

MELBOURNE FL
SEPT 6-7

PCARs 10th annual Hamfest at Melbourne Auditorium, Saturday and Sunday, September 6 & 7, 9 am to 5 pm. Prizes galore, exhibits, swap-tables, auction, Floridora's, QCWA and much more. First prize complete 40' crank-up tower, tri-band beam, rotator and coax and many more prizes. For more info write Box 1004, Melbourne, Florida 32901.

GRAYSLAKE IL
SEPT 6-7

Radio Expo '75 will be held September 6-7 in Grayslake, Illinois at Lake County Fair Grounds, Intersection Rts. 45 & 120. Thousands of dollars in door prizes, state of the art displays by major manufacturers, spacious, all-weather flea market, informative technical movies and seminars. Acres of free parking, free camp area and full food service. Tickets – $2 for both days, $1.50 in advance. Children under 12 free. Write to: Radio Expo Tickets, Box 1014, Arlington Hts. IL 60006.

MENA AR
SEPT 6-7

The Queen Wilhelmina Hamfest '75 is Saturday and Sunday, September 6 & 7 at Queen Wilhelmina State Park, Rich Mountain, Mena, Arkansas. Excellent accommodations and food at newly restored historic Queen Wilhelmina castle. Door prizes hourly, grand prize, new equipment displays, flea market, camping area with utilities and rest rooms, amusements for harmonics. Talk-in 146.52-3995. For more information write WB5GZR.

MALAGA NJ
SEPT 7

The 27th annual South Jersey Radio Association hamfest will be held on Sunday, September 7, starting at 10 am rain or shine at the Molia Farms Picnic Grounds, Malaga, N.J. (intersection of Routes 42 and 47). Swap shops, electronic equipment displays, prizes, ladies' games, swimming, you name it. Family picnic area with tables and outdoor grille; food may be purchased also. Free parking. Talk-in on 146.52 MHz FM Simplex. Advance reg. $2.50; $3.50 at the gate. For info or tickets write: Jack Koch K2MZP, 1980 Greentree Rd., Cherry Hill NJ 08003, SASE please.

FINDLAY OH
SEPT 7

The Findlay Hamfest will be held September 7, 1975 at Riverside Park, Findlay, Ohio. For advance drawing

additions and ~~corections~~ corrections

Please note these corrections on the item "Thirteen Billion Watts ERP?" which appeared on pages 4 and 5 of the July 1975 issue. They were pointed out to me by Lou Breetz, and have also been sent to *Auto-Call*.

The continuous rf power output should be 1 Megawatt, not 10 Megawatts, and the angular thickness of the fan pattern is 1.25 minutes from North to South, rather than 1-1/2 degrees.

Edwin P. Westbrook K3CS
Chairman, Publicity Committee
Naval Research Laboratory
Amateur Radio Club

Regarding my article, "How Gates Work" (July, 1975, page 113), many readers have spotted an error and brought it to my attention. On page 115, Table 9 *should* read as follows:

A	B	C	D	Q
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
.	.	.	.	.
.	.	.	.	.
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My only consolation (and a slight one at that) is that the readers apparently understood the article enough to find the mistake.

Larry Kahaner WB2NEL
4259 Bedford Ave.
Brooklyn NY 11229

tickets write Clark Foltz W8UN, 122 W. Hobart, Findlay OH 45840.

PEORIA IL
SEPT 14

The Peoria Area Amateur Radio Club's 18th Annual Hamfest will be held Sunday, September 14, at the Exposition Gardens, same place as last year. The site is located on Northmoor Road just west of University Avenue, at the northwest edge of Peoria. Lunch will be available, and there are activities for the entire family. Free swap session, parking, contests, cartoons for the children and many prizes. Advance registration $1.50 ($2 at gate). Banquet on Saturday, September 13, at V. Junction, $6 per person. For banquet reservations, write Larry Pearsall W9FDY, 2224 W. Herold Avenue, Peoria, Illinois 61604. For Hamfest tickets, write Earl R. Kimzey WA9SCA, RFD 1, Hanna City, Illinois 61536.

HARRISBURG PA
SEPT 14

Hamfest, sponsored by the Central Pennsylvania Repeater Association, will be held Sunday, September 14, 1975 at the Park-n-shop Parking Garage, 200 Block Walnut Street, Harrisburg, Pa. Gates open 9 am. Registration: $3 per ham – XYLs free – no charge for tailgating. Food available. Talk-in 146.16/.76 WR3ABV .94/.94. For more information contact W3ABF or WA3AVX.

SHARON MA
SEPT 17

The Sharon Amateur Radio Association is holding its annual auction on September 17, 1975 at 1 pm. At the Sharon Community center. Free refreshments and doorprizes. 10% commission to club. For further info contact Ed Levine, 6 Carlton Road, Sharon MA 02067. Tel. 617 784-6033.

HUDSONVILLE MI
SEPT 20

The Grand Rapids Amateur Radio Association will hold its annual Swap & Shop Saturday September 20, 1975 at the fairgrounds in Hudsonville, Michigan. Food & prizes, $2.00 at the gate – no charge for tables or trunk sales. Talk-in on 16/76 or 94/94. See you there!!!

ITASCA IL
SEPT 20

The 23rd Annual W9DXCC banquet will be held on September 20, 1975 at the Holiday Inn, Irving Park Rd., at I-90, Itasca IL, noon to ?? Contact the Indianapolis DX Assoc., 7008 W 71st St., Indianapolis IN 46278 for further details.

HAMBURG NY
SEPT 20

Hamburg International Hamfest will be held September 20, 1975 at the Erie County Fairgrounds. Features giant flea market, tech forums, displays, code contest, organization meetings, picnic facilities, FM hospitality room, women's programs, $3000 in prizes. Free parking except rec vehicles $2.50 for weekend. Admission $2.50 advance, $3 gate; flea market parking (set-up) $1. Banquet separate. Directions: NY Thruway to Blasdell Exit 56. Rec vehicles turn right on Mile Strip Rd, then left on Rt 62 So. Follow signs to fairgrounds. Other vehicles turn left on Mile Strip and right on McKinley Parkway. Talk-in WR2ABU 146.91, simplex 146.94, 7.255, 3.925. Other area repeaters WR2ACA (146.40) 147.00, WR2ADR 146.73. Info write Lin Brownell, 210 Buffalo St., Hamburg NY 14075; (716) 649-3106.

EL PASO TX
SEPT 20-21

The El Paso Hamfest will be held at the Vista Motor Hotel (special rates) on September 20-21. Special guest speaker and banquet Saturday night. For information write Charlie Wood WA5KYV, 10012 Suez, El Paso TX 79925. Talk-in on 28-88.

CINCINNATI OH
SEPT 21

Cincinnati Hamfest: 38th annual – Sunday, September 21, 1975 at the New Stricker's Grove on State Route 128, one mile west of Ross (Venice), Ohio. Flea market, contests, model aircraft flying, food and beverages all day. Advanced tickets $7, covers everything; $8 at gate. For tickets or further information: Carl J. Dettmar W8NCV, 8630 Cavalier Drive, Cincinnati OH 45231.

TEWKSBURY MA
SEPT 21

The 19 - 79 Repeater Association's second annual Clambake Hamfest is being held Sunday, September 21, at the Tewksbury Rod and Gun Club, 11 Chandler St., Tewksbury MA (off route 38 across from the Tewksbury State Hospital). Talk-in 19-79 and 52 direct. Lobster dinner – $8 per

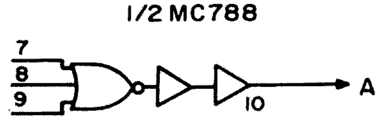
Continued on page 76

I have had a lot of response from the article "Homebrew This SSTV Monitor," which appeared in *73 Magazine*, June 1975, page 22, and I would like to add a few comments to the article.

Circuit Error:

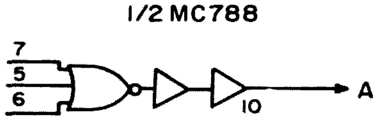
Was

1/2 MC788



Change to

1/2 MC788



Transistors:

All transistors, NPN and PNP, are general purpose, silicon type, except where noted.

Diodes:

All small signal diodes are 1N914 or equiv. Power supply diodes are 1 kV type such as 1N4007.

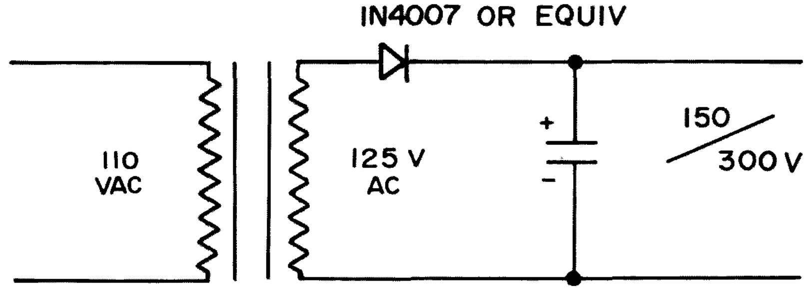
Power Supply:

Add the 150 V supply –

The 7.5 kV transformer was a one of a kind type. However, suitable power supplies can be used that deliver 5 - 10 kV. For additional schematics I would suggest consulting the SSTV handbook published by *73 Magazine.*

Larry Pryor WA9MFF
5940 Carrollton Ave.
Indianapolis IN 46220

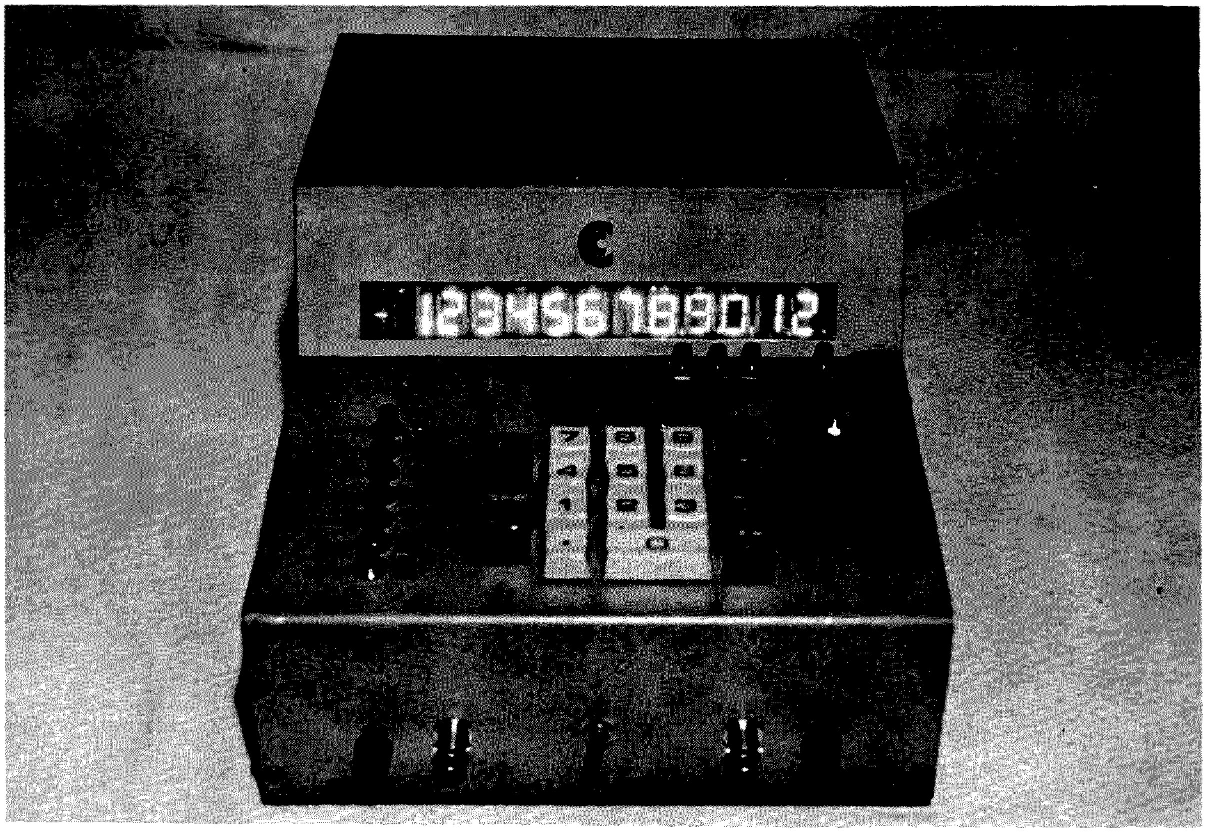
IN4007 OR EQUIV



Robert Johnson
5707 - 101A Avenue
Edmonton, Alberta T6A OL9
Canada

The Calculating Counter

And yet another electronic counter article? Yes, but with a difference. Traditional counters provide very limited resolution of audio frequencies associated, for example, with organ and piano tuning. The usual one-second gate time yields a reading varying between "59" and "61" for 60 Hz. To determine this frequency with any accuracy, you must measure the period of one cycle (16,666 microseconds), reach



Front view of counter. BNC inputs are: Left side – High impedance counter input; Right side – 50 Ohm impedance counter input, MHz prescaler. The switch transfers the prescaler between the two input jacks. The four push-buttons near the display are the decimal point setting controls.

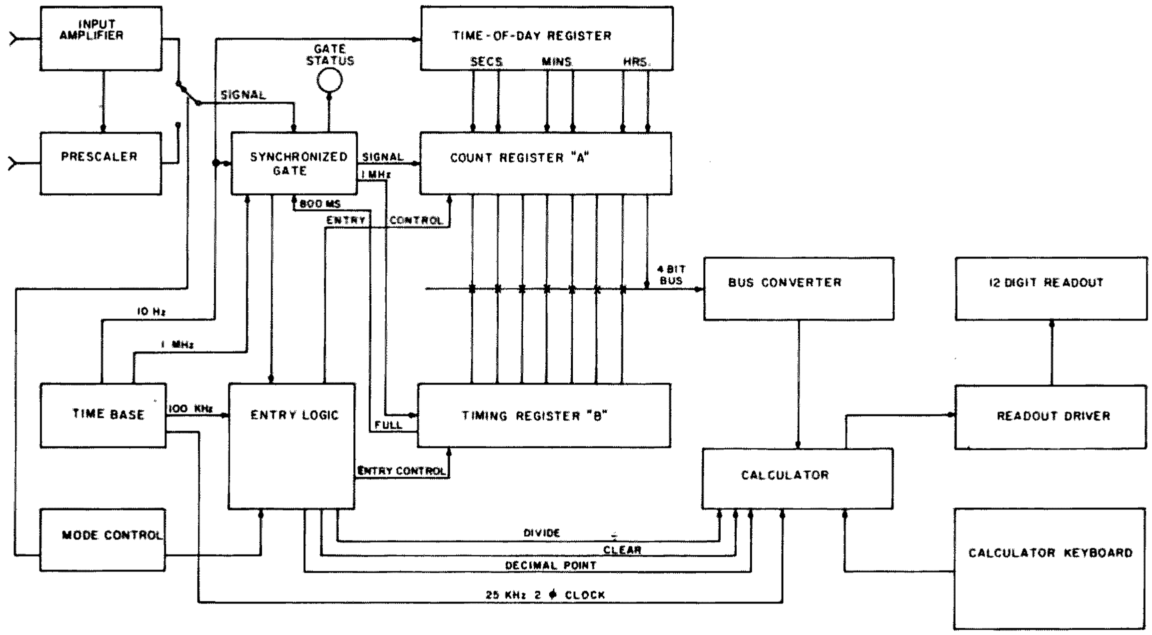


Fig. 1. Block diagram.

for your handy pocket calculator, and calculate the reciprocal (or wait 100 seconds perhaps!).

As our shack wasn't blessed with a handy pocket calculator, we decided to explore the possibility of teaching a counter to calculate frequencies from period measurements. It soon became apparent that designing a circuit to calculate reciprocals was no simple task. A ready-made solution to this dilemma presented itself in one of the "calculator chips" widely advertised at attractive prices. As a bonus, the problem of the missing "handy calculator" was solved as well. The "One-Chip Calculator" advertised as a type 5001 turned out to be both inexpensive and practical. The chip comes in one of two voltage ratings (for desk or pocket calculator use). While we used the low voltage model, which requires -8.5 and -13.5 volt power supplies, the higher voltage unit should be directly interchangeable, with minor power supply modifications.

We wished to construct an all-purpose counter, and our final design includes a basic 30 MHz counter, a high frequency prescaler, a reciprocal calculator, a desk calculator, a digital clock, an interval timer, and an incident counter. All logic circuits are TTL, except for the MOS calculator chip and ECL prescaler. Discrete devices are used for TTL/MOS interfacing and for driving readouts.

Design, construction and debugging of a project of this magnitude is virtually impossible without a test-breadboard facility. It is necessary to breadboard each function, and test it in turn. A suitable power supply is also essential, and we recommend construction of the power supply first, but note that use of different readouts or other components may require modification of the power supply.

Theory of Operation

Overall data and logic flow may be followed by reference to Fig. 1. The frequency to be counted is connected either to the input amplifier (high impedance) or directly into the prescaler (50 Ohms). The prescaler is automatically activated in the MHz mode. Note that the high impedance input may be used in all count modes, and it provides good sensitivity through the two meter band.

The synchronized input gate directs input pulses to register A, an 8 digit decade counter, and timing pulses to register B, a 6½ digit counter. Gate time in kHz and MHz modes is one second (plus or minus one input pulse period), and in the Hz mode varies between 800 milliseconds and 2 seconds (800 milliseconds plus one input pulse period).

When the input gate closes, entry logic is enabled, and in the kHz or MHz modes, the

contents of register "A" are entered serially into the calculator, which displays the entry just as if it had been made from the keyboard. In the Hz mode, the contents of register "A" are entered, trailing zeros are padded to improve resolution, and the "divide" function activated. The contents of register "B" are then entered, and the "divide" function again activated. This sequence causes the number of input pulses stored in register "A" to be divided by the number of timing pulses stored in register "B." The result (with the decimal point appropriately positioned) yields the frequency of the input (with up to 4 decimal places!). The bus converter interfaces the TTL registers with the MOS calculator, and changes the BCD coding of the TTL to conform to the 5001 chip's requirements.

The time-of-day register constantly contains the time, updated each second. Register "A" utilizes decade counters with preset inputs. In the time-of-day mode, once each second, the contents of the time-of-day register are strobed in parallel into register "A" and then serially entered into the calculator as in the kHz mode.

The accumulate and period modes cause the input gate to be controlled either manually or externally, and either timing or input pulses are routed to register "A" as appropriate.

Readouts

Selection of readouts is guided by desired digit size, price, availability, power supply and driving requirements. Readouts for use with the 5001 chip must have decimal points to the right of the digit.

Various readouts are suitable for use with calculator chips. The wide array of LED devices available suggests these would be preferred. Most calculator chips utilize multiplexed readouts, where like-segments of all digits are connected to a common bus line. Each digit is selected (turned on) for a brief period in turn. This driving method reduces wiring and driving hardware, because only eight segment drivers (including the decimal point) and one digit driver per digit are required.

LED readouts may be driven by the newly available 75491 and 75492 Darlington driver arrays; however, as they are NPN

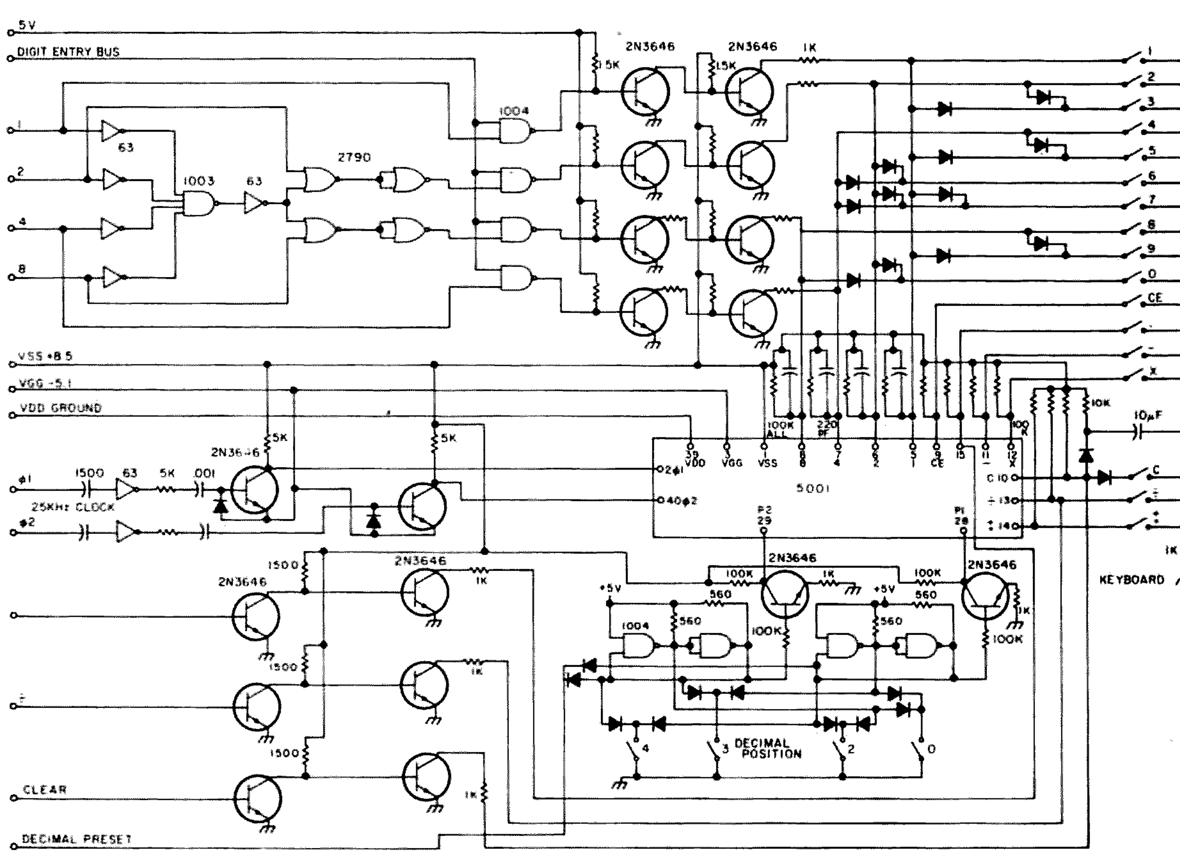


Fig. 2. Calculator Input Circuits.

devices, PNP predrivers may be required. Drivers shown in Fig. 3 are also suitable for driving LEDs, with the addition of limiting resistors.

Incandescent readouts require drivers capable of handling substantial inrush currents. Digit drivers should be selected to handle 500 mA. The author's choice of incandescent readouts was influenced by cost at the time, and size of display. Present LED prices make them much more attractive. Selection of the 2N3569 for drivers was influenced by our junkbox stock, but the 2N2905 (PNP) is probably more suitable. The calculator data sheet shows PNP drivers, and use of the 2N3569 (NPN) requires the circuits of Fig. 3 to make the NPNs think they are PNPs. Diodes are required for isolation between each segment and the segment bus. (This was rather painfully discovered by the author!)

Driving circuits for Nixie and Numitron type readouts are included with the calculator data sheet.

The 5001 chip provides 12 digits, which is handy for calculating, but not really needed for counting. Although fewer than 12 can be used, you must then either provide overflow detection or take a chance on errors. Note also that there are restrictions upon the size of the arguments that the 5001 can handle without overflow. These restrictions cause an overflow if you attempt to calculate the frequency to too many decimal places. (You have the choice of zero, 1, 2, or 4 decimals.)

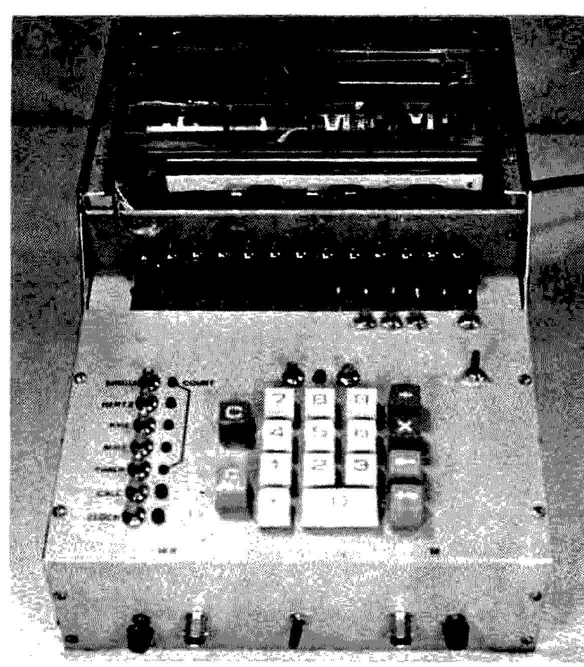
The Calculator

The 5001 Cal-tex chip widely advertised is probably the most suitable for this application. Data input is modified BCD, and is readily driven from TTL Circuits. The 5005 and several others use multiplexed inputs, which require more complex input interfacing. Although no investigating was done, the 4016 CMOS switches should be suitable for use with multiplexed inputs. The 5001 is available in 2 voltage versions. If you are not sure which version you have, it would be sensible to use the lower voltage supply to test it. Mine turned out to be the 13 volt version. If yours works at the lower voltage, it is a low voltage unit and should not be tested at the higher voltage. (Murphy's Law must have been temporarily repealed, as mine survived!)

Table 2 lists equivalents of various components used by the writer. We were fortunate to locate a supply of surplus boards, each carrying about 30 TTL NAND gates with open collectors. At about 2¢ per IC, these found favor with the pocket book. (Use of a soldering iron tip designed for their removal is recommended.)

TTL and ECL are devilish creatures unless adequate power supply by-passing is done. The surplus boards noted above also yielded some very handy power bus strips. These are composed of two 3/8" wide strips of copper foil separated by a thin dielectric. Feed terminals are provided at convenient locations which permit short leads to ICs. Even with use of these bus strips, 1.0 mF (miniature electrolytic) and .1 (miniature ceramic disc) capacitors were liberally distributed from +5 volts to ground. A .1 discap across the supply terminals of every TTL and ECL IC is recommended, if you don't use bus strips. Failure to provide these bypass capacitors will result in miscounts at best, and total non-operability at worst.

Fig. 2 shows the various input circuits required for the 5001 chip. Pins 5, 6, 7 & 8



With the top cover removed, the incandescent readouts may be seen. The four Nicad batteries may also be seen.

are 1, 2, 4 & 8 BCD lines, with the exception that a zero is read in as a "10" (lines 2 & 8 low). A low reading on any line results in a digit entry. The "digit entry" converter at the top of the diagram converts a zero entry into a "10." The "digit entry" bus is driven high whenever a digit is to be entered, opening the 4 NAND gates to the 2N3646 level converters.

Level converters are also provided for the decimal point entry, divide function and the clear function. Although non-synchronous calculator clocking could have been used as shown on the 5001 data sheets, we chose synchronous clocking to minimize cyclic errors, and tapped a 25 kHz signal from the time-base countdown chain. Electronic, rather than mechanical decimal point switching, was chosen to permit automatic decimal point placement when selecting functions. (And after all, who wants a rotary switch in a project like this?)

Fig. 3 shows outputs from the calculator chip. A Quasi-Darlington connection is used for digit drivers. The digit drive transistors must be maintained in full saturation, otherwise an "8" display will result in a dimmer digit than a "1," not to mention possible destruction of the transistor. Digits 3 & 6 (from right) are blanked in the time-of-day mode.

Segment drivers need not be high current devices as no more than one digit at a time is turned on (which means segment drivers only carry the load of one segment). Remember, however, the substantial inrush current if incandescent readouts are chosen.

Mode switching uses 8 NAND gates connected as 4 flip-flops. These gates serve as an instruction register and their outputs control the various logic circuits. LEDs are provided near each mode switch to indicate which mode has been selected.

Input Gating

A simple gate which opens for a fixed period of time is not adequate for use when calculating frequency from period measurements. The synchronized gate used here ensures only full pulses are counted, as opposed to a random gate which may open or close in mid-pulse. This substantially

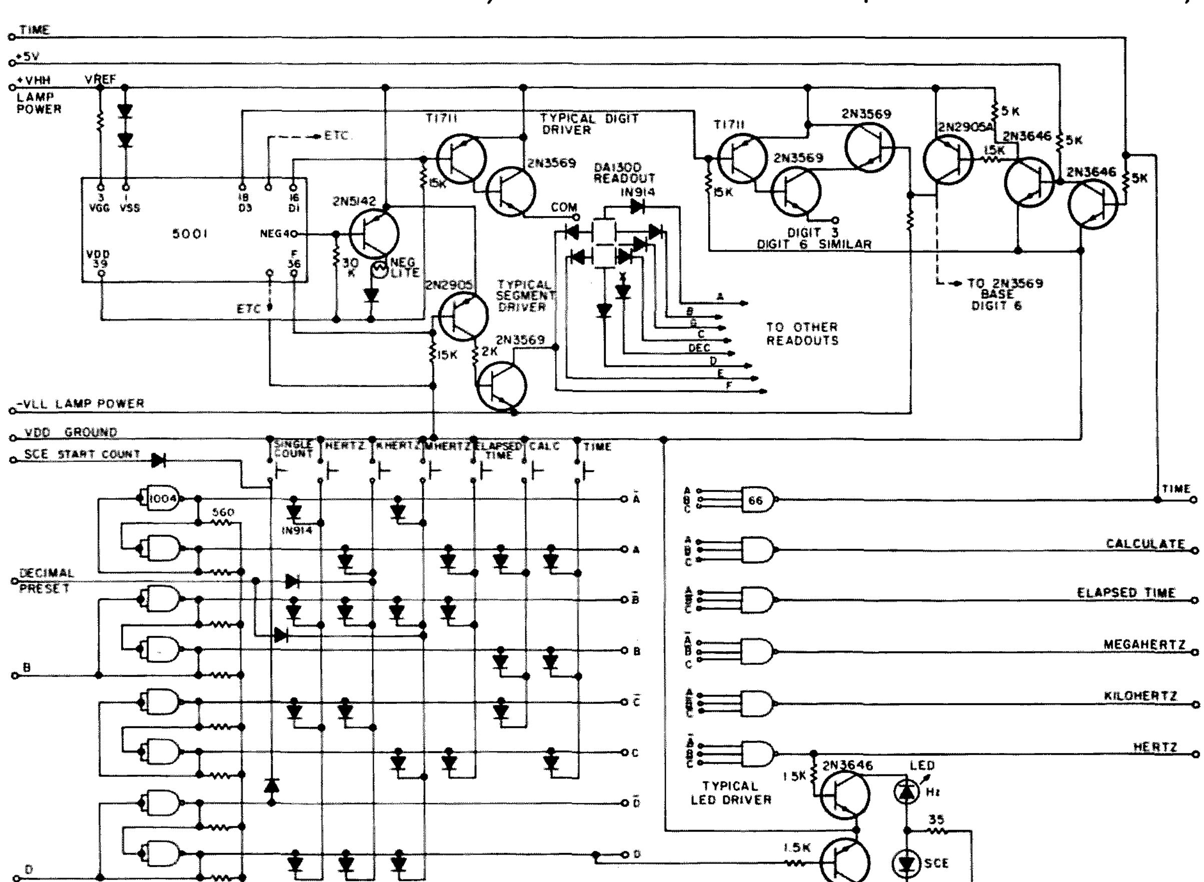


Fig. 3. Readouts and Mode Switching. The neg. light is the G-segment of the left-most readout.

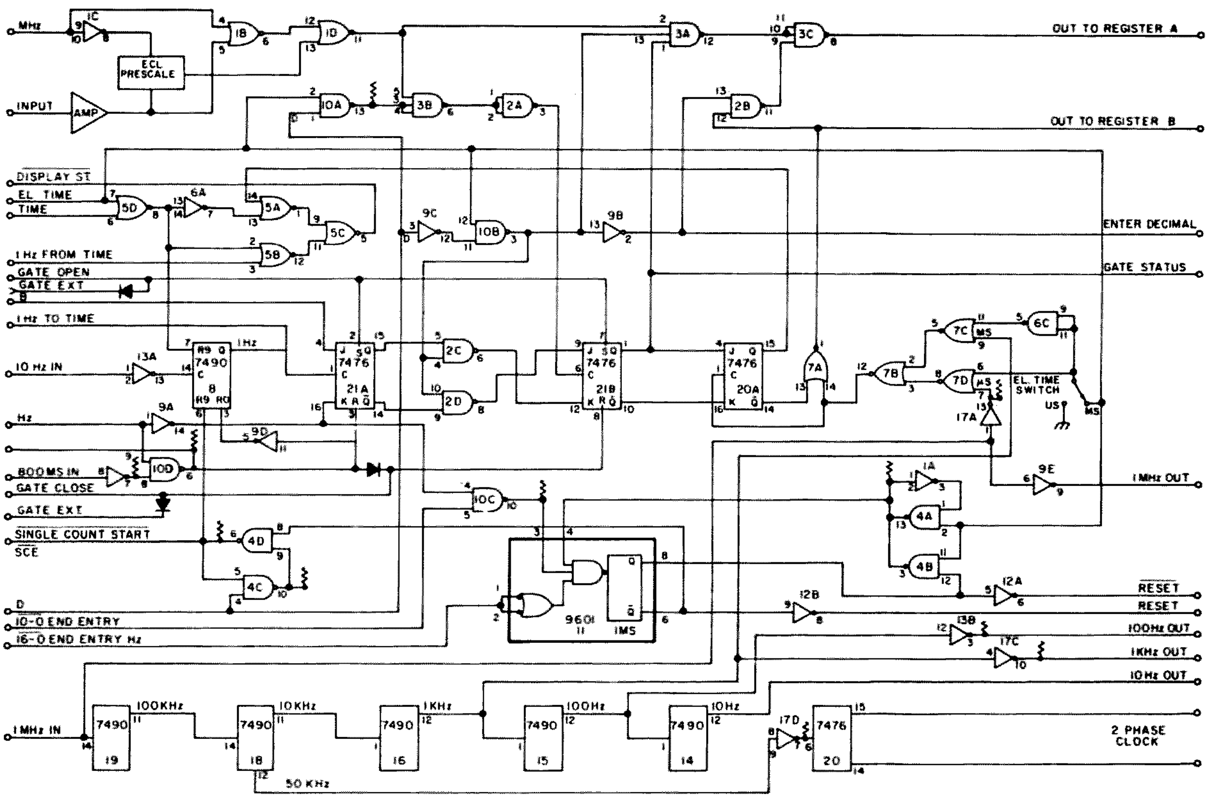


Fig. 4. Input Gate, Clock and Reset.

improves accuracy in the frequency calculate (Hz) mode, and reduces hunting of the last digit which is common to all counters.

The front end of the input board (Fig. 7) includes a wideband amplifier[4] and a high speed prescaler[2], both described later. Gates in the signal path (1D, 2A, 3A, 3B, 3C), flip-flop 21, and the input divider of register "A" should be selected for high speed performance.

Assume for the moment that decade divider 8 is enabled (Fig. 4), and we are in the kHz (Standard Count) mode. The first 1 Hz pulse arriving at the count input of FF 21A causes the Q output to go high (gates 2C & 2D are enabled via gate 10B and the J & K inputs of FF 21B are conditioned to permit it to toggle "on"). The input signal is routed to the count input of FF 21B via gates 1B, 1D, 3B and 2A and the first subsequent input pulse causes FF 21B to turn on. Gate 3A is now enabled, and following input pulses are routed to register A via gates 3A and 3C. FF 20A was also set to toggle "on" by FF 21A and the first 1 MHz pulse at the count input of FF 20A causes it to turn on, and gates 5A and 5C cause the display-start line to go high. This readies the display entry logic. (1 MHz pulses are routed to register "B," but are not used in this mode.)

After exactly 1 second, FF 21A switches off, and conditions FF 21B to switch off. The next input pulse causes FF 21B to switch off, and gate 3A closes. Register "A" now contains the count of input pulses during a one second interval. FF 20A promptly switches off (about 1 microsecond later), the display-start line is brought low, and the digit entry logic is initiated. When all digits have been entered (about ¼ second), the 10/0 line goes low, and the one-shot generates a 1 ms reset pulse, which clears registers "A" and "B," and simultaneously sets decade divider 8 to a count of 9, through gate 4D. About one tenth of a second later (in the continuous count mode), divider 8 reaches a full count, transmits a pulse to FF 21A, and a new count cycle begins.

Single Count

When line D is high, after the count/display sequence, gates 4C and 4D are locked up by the reset pulse, and divider 8 is held at a count of 9. The start (SCE) line is brought down each time the single count

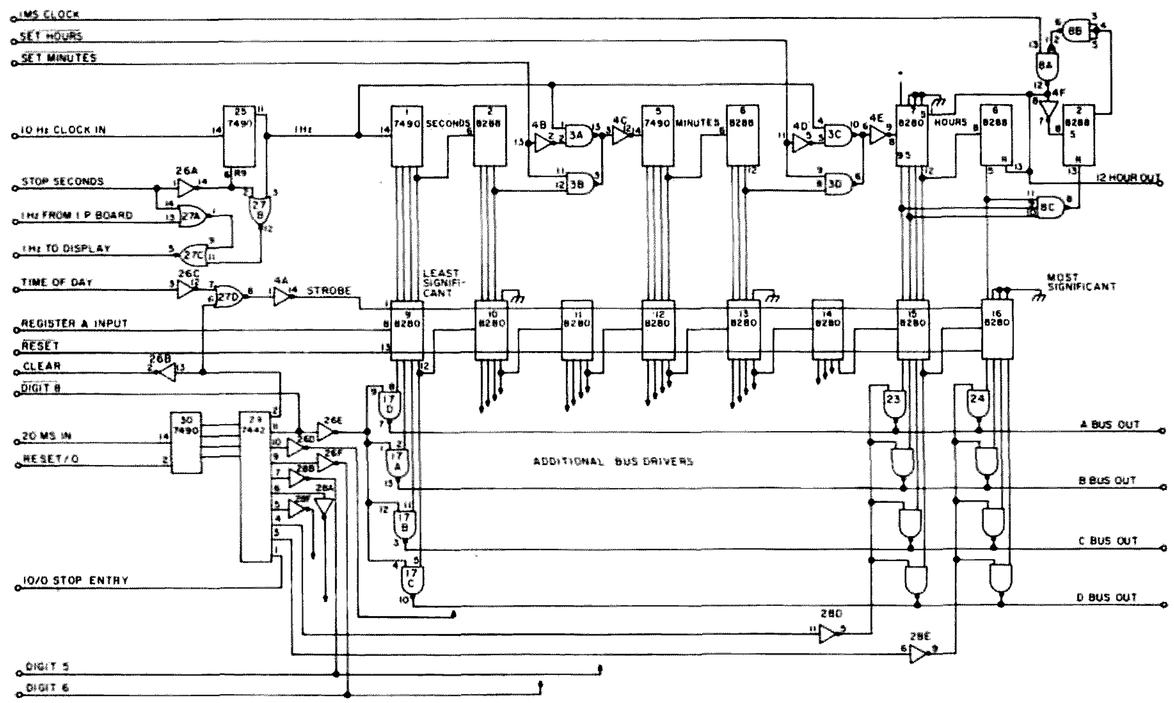


Fig. 5. Register "A" and Digital Clock.

push-button is operated, restarting divider 8, a new count, and resetting gates 4C and 4D.

Calculate Frequency (Hz) Mode

A logical 1 on the Hz line enables gate 10D, prevents FF 21A from resetting from its count input, and prevents (gate 10C) the 10/0 line from initiating a reset pulse. Gate 3A is enabled via FF 21A and FF 21B, similar to the kHz mode. It should be noted that FF 20A (which follows gate 3A by 1 microsecond) routes 1 microsecond pulses via gate 7A to register "B" in all count modes. In the Hz mode, when register "B" has counted 800 milliseconds, it sends a pulse via gate 10D to reset FF 21A. The next input pulse closes gate 3A via FF 21B, and gate 7A closes about 1 microsecond later. Register "A" now contains the number of input pulses which were counted during the time (in microseconds) stored in register "B." The display-start line causes entry of the number stored in register "A," a "divide" function, the period measurement in register "B," and a second divide (equals) function (which calculates the frequency), and initiates a reset pulse via the 16/0 line.

Elapsed Time and Event Counting Modes

When the elapsed time line is high, divider 8 is disabled via gate 5D, and either input pulses or timing pulses are routed to register "A," depending upon the status of "D" (gates 9B, 9C and 10B). Microsecond or millisecond timing pulses may be selected by a back panel switch. In the elapsed time mode ("D" is low), the gate may be operated via the regular counter input, or via the manual or external gate inputs. Pressing "Single Count" and "Elapsed Time" together selects event counting, and input pulses are routed to register "A" when the gate is opened manually or externally. In these modes, display-start occurs once each second (gates 5D & 5B), and the reset generator is disabled via gates 1A, 4A and 4B. A single reset pulse is generated each time this mode is selected, which permits each count to start from zero.

Clock and Countdown Chain

In order to assure count accuracy, the clock oscillator must have high stability. The circuit chosen[6] has proven to be very stable. There is little sense in providing 7 or 8 digits of readout unless the clock oscillator is stable to 10^7 or 10^8 or better.[4] When the digital clock is adjusted to keep time to ½ second in 10 days, accuracy is better than 10^6. Methods of obtaining better accuracy are available, but are beyond the scope of this article.[3] The oscillator is further discussed later.

All devices in the clock chain, and the time-of-day register are provided with battery standby. Interfacing between these devices and other logic devices was made via open collector buffers. Provision of pull-up resistors to the regular 5 volt line, and powering these buffers from the battery, avoids the possibility of glitches when the counter circuits are switched off.

Registers

Data registers and associated logic are diagrammed in Fig. 5 and 6. Referring first to Register "A," it can be seen that pulses presented to the input are counted during the interval the input gate is open. When the gate closes, counting stops and Data Entry Logic is enabled. Divider 30 (Fig. 5) is caused to count up, at a 20 millisecond rate, from "zero" through 8, and then resets to "zero." Decoder 29 changes the BCD output of divider 30 to a "one of ten" output. Each group of 4 gates to the data bus is enabled in turn, which causes the BCD output of the associated decade counter (high order first) to be presented to the BCD data bus (gate 24 presents divider 16, gate 23 presents divider 15, etc.). When divider 30 reaches the count of 8, a signal on the "stop entry" line stops further counting of divider 30, resets it to "zero," and in turn prevents further data entry.

At this stage, the calculator is displaying the contents of register "A." In the kHz and MHz modes, no further data entry occurs, and a new count cycle begins. Data Entry Control Logic will be discussed more thoroughly later.

The time-of-day register utilizes decade and divide-by-twelve dividers to determine the current time. Gates 26A, 27A, 27B, 27C and divider 25 are provided to permit setting the clock. Dividers 1 and 2 divide the 1 Hz pulses by 60, providing one minute output pulses, and storing the "seconds" of the time. Dividers 5 and 6 similarily divide by 60 providing "minutes", and an hourly output pulse. Divider 7 and the divide by 2 (flip-flop) portion of divider 6 provides a 12 hour count register. When a count of "13" is sensed by gate 8C, the hour register is preset to 1 through the action of FF2 and gates 8B and 8C.

The 8280 dividers used in register "A" have a very valuable feature. When the strobe input is raised to logic "1," the divider is preset to the value found on its BCD inputs. This feature permits parallel loading of time-of-day data into register "A" simply by strobing the 8280 dividers.

Time-of-day can then be entered into display, just as if it were a "count." Note that the digits between the "seconds" and minutes, and between the "minutes" and

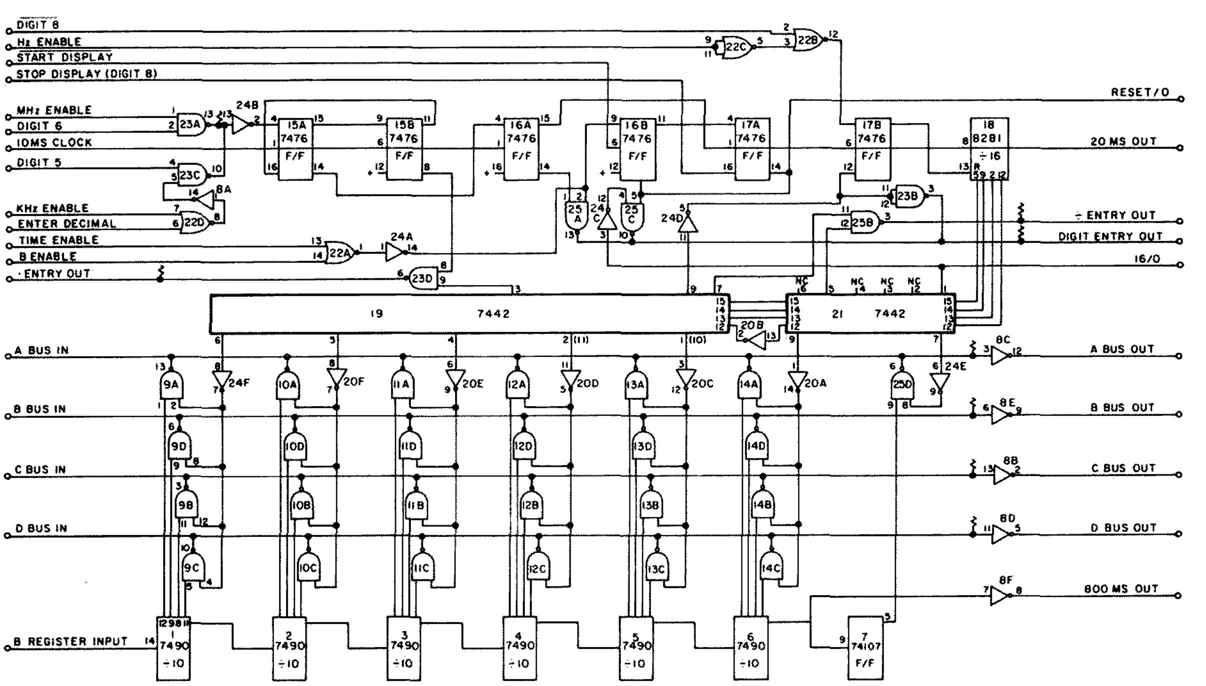


Fig. 6. Register "B" and Entry Logic.

Count Mode – kHz

Decimal Point Preset at "3"

1. Open Input Gate
2. Close Input Gate (1 second later)
3. Clear Display (CE)
4. Enter 5 High Order Digits From Register "A"
5. Enter Decimal Point
6. Enter 3 Low Order Digits From Register "A"
7. Clear Registers

Count Mode – MHz

Decimal Point Preset at "3"
Prescaler Activated

1. Open Input Gate
2. Close Input Gate (1 second later)
3. Clear Display (CE)
4. Enter 6 High Order Digits From Register "A"
5. Enter Decimal Point
6. Enter 2 Low Order Digits From Register "A"
7. Clear Registers

Count Mode – Hz

1. Open Input Gate
2. Open Clock (Register "B") Gate
3. Close Input Gate (When Register "B" Full)
4. Close Clock Gate
5. Clear Display (CE)
6. Enter 8 Digits From Register "A"
7. Enter Three Zeroes
8. Enter "Divide" Command
9. Enter 4 High Order Digits From Register "B"
10. Enter Decimal Point
11. Enter 3 Low Order Digits From Register "B"
12. Enter "Equals" ("Divide") Command
13. Clear Registers
    (Delay New Count Cycle to Provide 2 Second Update)

Elapsed Time Mode

Route Clock (MS or uS) Pulses to Register "A" (gated)
Route Input to Control Input Gate
Update Once Each Second
Clear Register "A"

1. Clear Display (CE)
2. Enter 5 High Order Digits From Register "A"
3. Enter Decimal Point
4. Enter 3 Low Order Digits From Register "A"

Accumulate Count Mode

Route Input Pulses to Register "A"
Update Once Each Second
Clear Register "A"

1. Clear Display (CE)
2. Enter 8 Digits From Register "A"

Time-of-day Mode

Blank 2 Digits
Update Once Each Second

1. Clear Display
2. Load Register "A" From Time-of-Day Register
3. Enter 8 Digits From Register "A"

Calculate Mode

Lock Out Data Entry Sequencer
(Keyboard Always Live)

Continuous Count Mode (Hz, kHz, MHz)

Enable Automatic Count Restart (input gate) on Register Clear Signal

Single Count Mode (Hz, kHz, MHz)

Manual Count Restart (input gate)

Table 1. Calculate/Count Program.

"hours," are blanked in the display, so a dummy entry must be made in these 2 positions of register "A."

Data Entry

Register "B" (Fig. 6) does not require parallel entry, so 7490s were used here (more readily available and cheaper).

In the "Hz" modes, divider 18 is caused to count from "zero" up through "15" to zero. Two 7442 decoders provide a one-of-16 output from the BCD output of divider 18. Table 1 shows the data entry "program" for the various modes. Flip-flops 15, 16 and 17, along with associated gates, provide for entry control of both registers, and flip-flops 15A and 15B enter a "decimal" point in the appropriate place during register "A" entry.

Flip-flop 16A is normally enabled, and provides 20 millisecond pulses to the two data entry sequencers. Gate 25A signals the bus converter that there is valid data on the bus, and the converter in turn presents this data to the calculator for 10 milliseconds. The action of flip-flop 16A is inhibited (and no digits are therefore entered) during decimal point entry. Although the 5001 data sheet states 4 ms is required for data entry, anything faster than the 20 ms data entry cycle rate chosen was found to be unreliable with my bargain price 5001. Flip-flop 16B switches "on" in response to a pulse on the start-display line (input gate closure). Flip-flop 17A is then permitted to toggle "on," which unlocks the register "A" data entry sequencer, and the "digit entry" line (gate 25C). Register "A" entry sequencer then counts up (entering digits), and when it reaches a count of "8" the stop-display line permits flip-flop 17A to toggle off, which

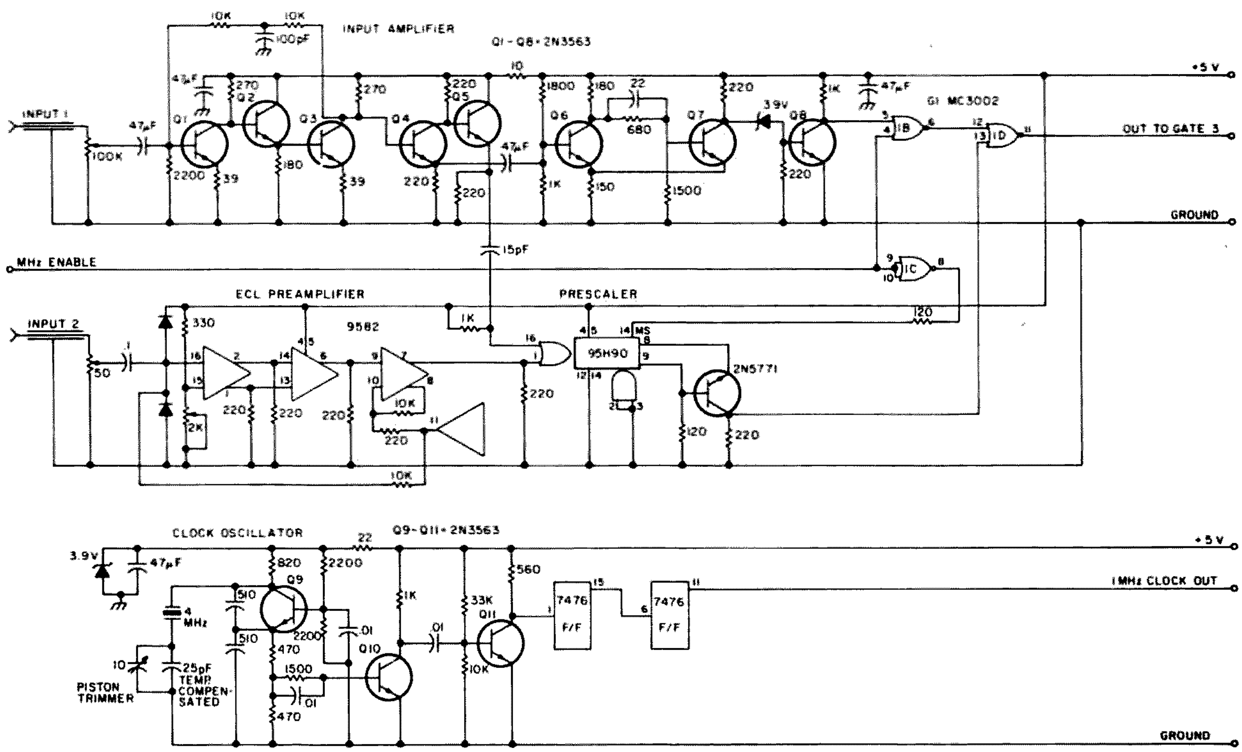


Fig. 7. Details: Input Amplifier, Prescaler, Clock Oscillator.

resets the entry sequencer to "zero" and stops further entry of register "A."

In the "Hz" mode, a count of "8" on the register "A" entry sequencer permits flip-flop 17B to toggle "on" which enables the 8281 register "B" entry sequencer (18) and unlocks the digit entry line at gate 25C. Register "B" entry sequencer then counts up, entering register "B," and at count 15 gate 24D enables the flip-flop 17B "K" input. The next count pulse causes sequencer 18 to return to a "zero" count, and simultaneously toggles flip-flop 17B "off," which disables divider 18.

Input Amplifier and Prescaler

Details of the input amplifier and prescaler are shown in Fig. 7. The input amplifier uses low-cost high speed 2N3563 transistors throughout. The input amplifier has a passband from ½ Hz through at least 150 MHz. This amplifier is described elsewhere[4] and is highly recommended. (Some resistor changes were found necessary to optimize response.) The 9582 ECL preamplifier was found to have less sensitivity than the discrete preamp, and stability proved a problem. In retrospect, the writer would eliminate the ECL preamp, and use the discrete preamp for all input signals. (Reference 14 discusses improvements to the prescaler.)

The 95H90[2,11] prescaler functions exactly as expected. Again, power supply impedance is critical[2] and .01 discs must be used liberally to ensure stability. The output transistor as recommended is a 2N5771.

Clock Oscillator

Time base stability is very important if accurate counts are to be expected. The oscillator circuit[6] was chosen after much experimentation. The crystal is a 4 MHz HA type (high accuracy) ordered for room temperature use. This frequency seems to be about optimum for thermal stability, and use of a series/parallel combination of NPO and negative temperature capacitors for the crystal series capacitor permits stability to be adjusted.[3] The 10 pF capacitor is a glass piston trimmer and can be anything smaller than 10 pF (4 pF probably is about right if you can find one). Q9, Q10 and Q11 are 2N3563 or 2N4274. Use of this oscillator permits stability to 1 part in 10^7 or better without an oven. The author's unit keeps time to better than ¼ second to WWV over a two-month period. Only a very slight difference in time-keeping ability was noted when the unit was run "warm" for a similar period.

Mode Switching

Use of 8 open collector TTL 2 input NAND gates (or inverters) connected as 4 S/R flip-flops permits a completely electronic mode switching system. The configuration of these flip-flops is set by pressing one of the mode push-buttons. The flip-flops then "remember" what mode switch was last pushed.

Outputs at the first three flip-flops are decoded by six 3-input NAND gates. The fourth flip-flop is used to control the single count function, and also, together with the "elapsed time" mode, to provide an "accumulate" mode. LEDs indicate the mode presently in use. Operation of either the kHz or MHz button presets the calculator to 3 decimal places. This permits display of the decimal in the appropriate location. An extra decimal point LED was mounted between the 5th and 6th digits (from the right) and connected via a driver to the MHz function. This provides a reading of xx.xxx.xx in this mode. (Although it might appear that the MHz function should preset 2 decimal places, the decimal point is entered in the proper place by the data entry logic.) Germanium diodes should be used in the "decimal preset" line to ensure that TTL inputs are brought below their switching thresholds.

Power Supply

In order to avoid loss of power to the digital clock, a battery standby has been provided for the clock circuits. Referring to Fig. 8, a constant current regulator, comprised of a 2N3055 and a 2N3569, maintains the Nicad battery in a fully charged state. The voltage regulator using another 2N3055 and a 2N3698 is somewhat unusual. A voltage doubler driven by G1 and G2 provides sufficient current to the 2N3055 to maintain it in saturation when the input voltage drops to 5.2 volts or less. This ensures adequate output voltage to drive the TTL clock circuits until the battery voltage drops to about 4.7 volts. At this point, zener diode Z1 (with diodes D5 and D6) reduces the base current to the 2N3055, which results in a drop in output voltage. Lowered voltage to the TTL countdown chain causes a loss of clock drive to the voltage doubler, and results in a complete shut-down of the voltage regulator. Deep discharge of a Nicad

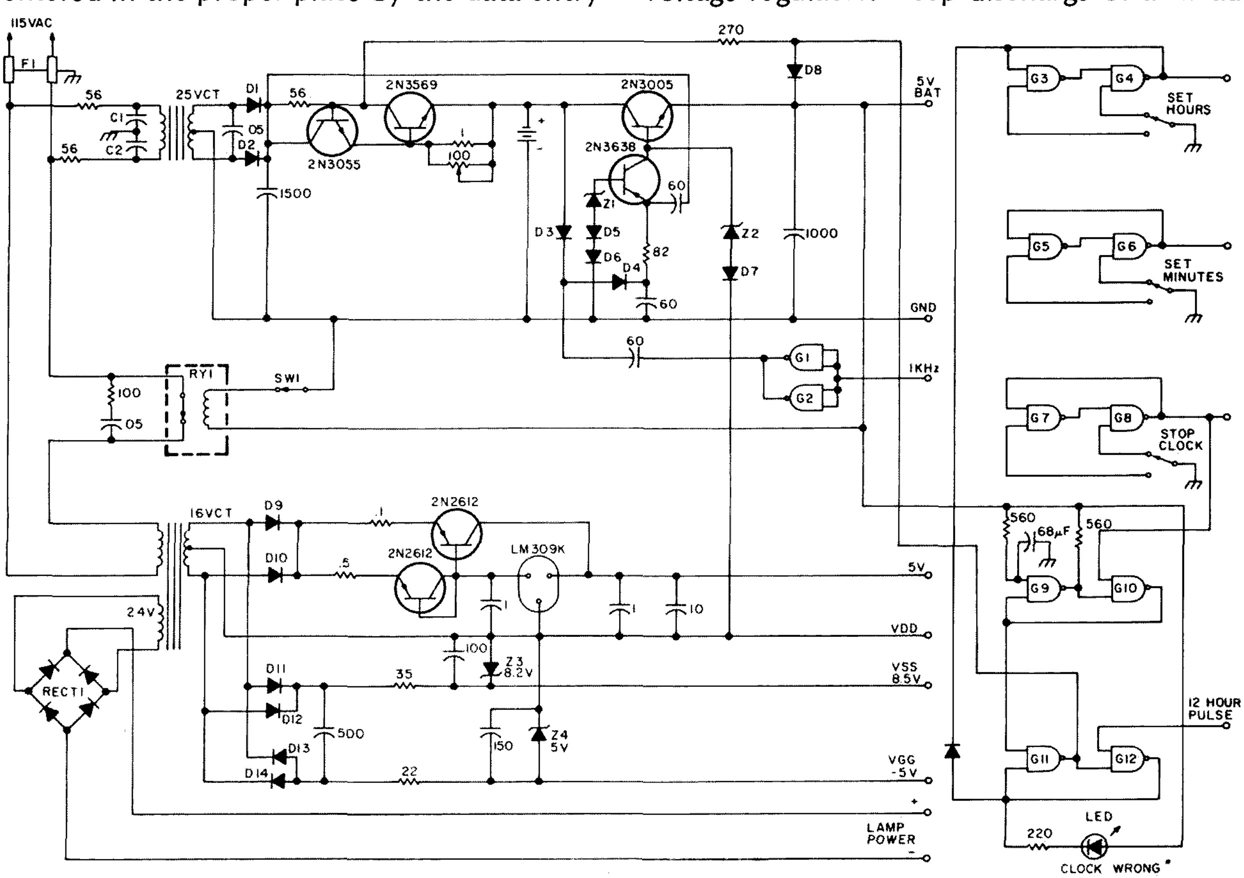


*Fig. 8. Power Supply. *This LED signals a power off condition until the clock is reset.*

battery would result in permanent cell damage.

Zener diodes Z1 and Z2 with their associated forward diodes must be chosen to provide about 5.7 volts at the base of the 2N3055, and about 5 volts at the base of the 2N3638. (Note that throughout this project transistors were chosen mostly for their ready availability in the writer's junkbox, and suitable substitutions are in order.)

REGISTER "A"

Device Number	Device	Similar Equivalent
1	7490	
2	Signetics 8288	74193, 74161
3	RM1004D	7401, 7403
4	F3005663	7404
5	7490	
6	8288	
7	8280	74160, 9310, 74192, 8310
8	7410	
9 – 16	8280	
17 – 24	RM1004D	
25	7490	
26	F3005663	
27	SN2790N/F3005664	7402
28	F3005663	
29	7442	
30	7490	

REGISTER "B"

Device Number	Device	Similar Equivalent
1 – 6	7490	
7	74107	
8	F3005663	
9 – 14	RM1004D	
15 – 17	7476	
18	8281	74161, 9316, 8316
19	7442	
20	F3005663	
21	7442	
22	SN2790N	
23	RM1004D	
24	F3005663	
25	RM1004D	

INPUT SYNC

Device Number	Device	Similar Equivalent
1	MC3002	7402
2	7400	
3	7410	
4	RM1004D	
5 – 7	SN2790N	
8	7490	
9	F3005663	
10	RM1004D	
11	MC9601	
12	7440	
13	RM1004D	
14 – 16	7490	
17	RM1004D	
18 – 19	7490	

READOUTS

Device Number	Device	Similar Equivalent
1 – 2	RM1004D	
3 – 4	F3005666	

INPUT CIRCUITS

Device Number	Device	Similar Equivalent
1	RM1003D	MC3007

POWER SUPPLY

Device Number	Device	Similar Equivalent
G1 – G8	7400	
G9 – G12	RM1004D	

Table 2. Devices and Equivalency. Duplications not listed.

The main 5 volt supply[13] uses a PNP 2N2612 transistor to provide about 4 Amperes of regulated dc, controlled by the 1 Ampere LM309K. The second 2N2612 is diode connected to provide a voltage drop similar to the base-emitter drop of the pass transistor, and as it is mounted on a common heat sink, provides thermal stabilization. MOS voltage levels are provided by simple zener regulators. Note that Vdd is grounded, whereas the 5001 data sheet references voltage levels to Vss. Lamp power is unfiltered, which reduces readout brilliance changes with the widely varying readout load.

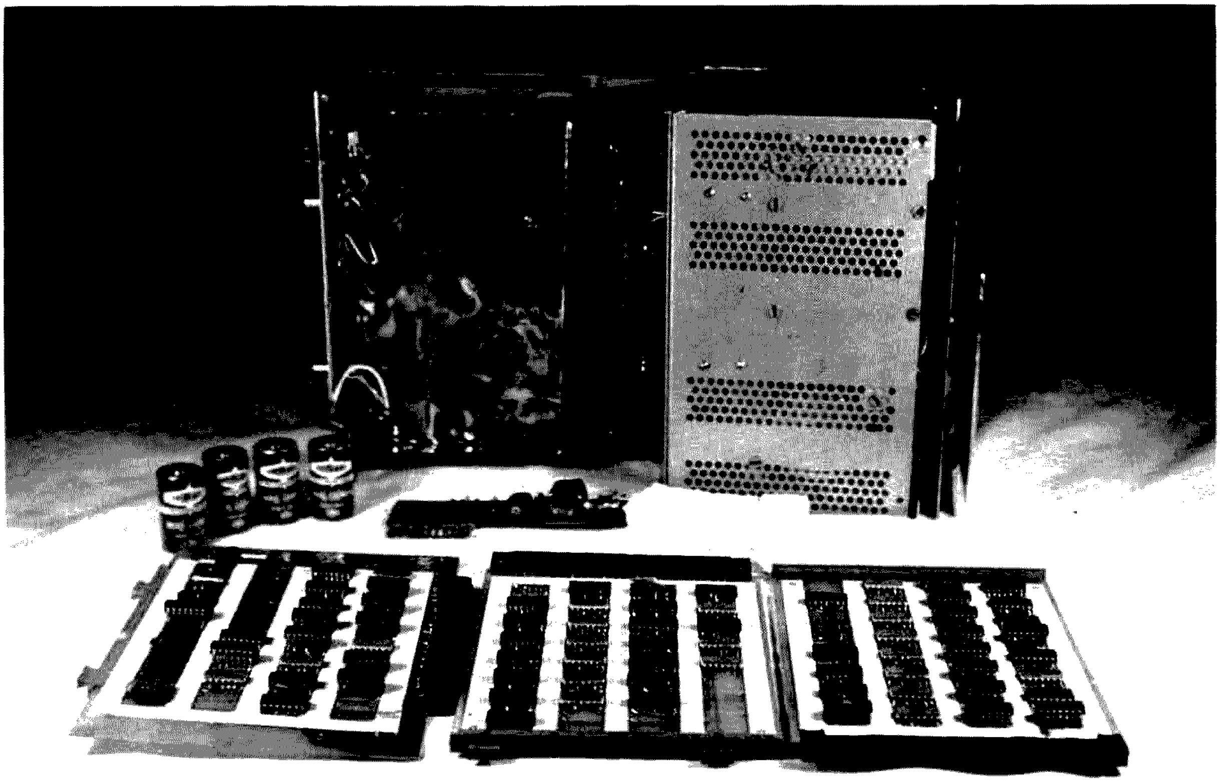
Three bounceless switches are provided for setting the time. Gates G9, G10, G11 and G12 increase the battery charge rate upon restoration of power after discharge. The high rate continues until first the "stop clock" (set seconds) switch is operated, and then a 12 hour pulse is received at midnight or noon. (That is, the high rate stops at noon or midnight after the time has been reset.)

Using the Calculating Counter

The completed counter has proven to be a very useful tool. By merely switching the unit on, the precise time is immediately displayed. Instead of those laborious parallel resistor computations with pad and paper, a precise calculation can be quickly made on the calculator. A short piece of wire attached to the input and placed near an antenna allows checking of transmitter frequencies. (A hand held business portable yielded a reading of 155.610.15 MHz – authorized frequency 155.610.)

As indicated earlier, while we wished to be able to measure frequencies through 2 meters, low audio frequency resolution was a prime target. All frequencies above 10 Hz may be measured to 5 or more significant figures. (A sixth digit shows, but as previously mentioned, hunting in the last digit cannot be eliminated.) Frequencies down to about ½ Hz may be determined to 3 (plus one) decimal places, if your obsession happens to be in this area.

Measurement of frequencies from the author's electronic organ proved easy with use of a microphone and a preamp, but the piano proved to be a little more challenging.



Bottom view of counter. The shiny surface on the left is a copper shield between the input board and the calculator boards. The oscillator board is in the center. Left is the input board, and the other two boards contain the time-of-day register and the count logic and registers.

A recent article[15] described a combination oscillator/tunable filter. When connected between a microphone preamp and the counter, the filter permitted a fundamental to be isolated from its harmonics. Furthermore, the high "Q" of the filter acts to sustain the note long enough to permit measurement. When a piano key is struck, and the single-count button operated immediately, a count may be accurately obtained before the note decays. It is said that a mechanical tuner cannot properly tune a piano, as octaves are not precise multiples, and multiple string notes have delicate differences in the tuning of the individual strings. One might nevertheless learn much by exploring a tuned piano.

It is the writer's hope that this article may evoke an interest in the many MOS devices currently on the market at most attractive prices.

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[3] "Mainline FS-1 Secondary Frequency Standard", W6FFC, *QST,* Nov '68.

[4] "Time-Frequency Measuring System", K5OUS, *73,* Oct '72, Feb '73, March '73.

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[6] "Compact Frequency Counter", K4EEU, *Ham Radio,* July '70.

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[8] "Heath-Model 1B-101 Frequency Counter", *Techni-Guide, Electron,* Feb '71.

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A Satellite Fax System You Can Build

Part One

One of the more persistent questions which I encountered in correspondence regarding my previous articles on weather satellite picture displays is why I didn't work up something for facsimile display of satellite pictures. I have always had a certain attraction to facsimile and the only thing that kept me out of that particular ball game was sheer mechanical ineptitude. I felt that I was at my limit using a simple chassis punch, and the thought of trying to construct a piece of "precision" facsimile equipment seemed a little more than I was willing to try. Prodding by Lindsay Winkler W6WMI, the author of the interesting article on an SSTV FAX machine (73, March 1973) was constant. Wink kept sending me some excellent pictures produced by Virgil Neher W6KT using a homebuilt photographic facsimile system and I finally had to give it a try – if only to retain my charter membership in the Lost Order of Home Brewers. The present project, which represents the illicit union of integrated circuits, some tried and tested tube circuits (you do remember tubes, don't you?), miscellaneous plumbing fixtures, and a kitchen rolling pin, was the final result. As it turns out, both CRT and FAX systems have strong points and shortcomings, which I will detail later. An active weather satellite station should have capability for both modes.

The circuit details described here assume that you will be starting from scratch. The electronics are very straightforward, with the main challenge being the mechanical tinkering to arrive at optimum performance. No fancy machine tools are required – I don't have any and if I did I would probably only maim myself – so rest assured that you can Rube Goldberg yourself into the ballpark with nothing more than normal workshop tools. The project uses tubes in some parts of the circuit, so you will be able to justify having kept all that junk around if the XYL is still asking.

The first question that might occur is why build from scratch? Why not modify a commercial machine? The answer is that a photographic system, printing directly on photographic paper, is not only fast and cheap, but gives the best possible picture quality. Very few photographic facsimile machines are available and all would require extensive modification to the point where it's easier to start from ground zero. Similar systems can be worked up from machines using Teledeltos papers (Deskfax) or the better Alden machines and papers, but the results achieved, while adequate, will suffer in comparison to either a CRT or photographic facsimile system.

Principles of Operation

Fig. 1 shows a block diagram of the FAX system. There are two ways to look at the

NOAA satellite video format. It can be considered at 48 line per minute format, in which half the line represents IR data and half visible light data. Alternatively, the format can be viewed as a 96 line per minute system in which alternate lines of visible and IR data are displayed. On this run through we will use the first of these. If satellite video is arriving at the rate of 48 lines per minute, we have to rotate the drum of the facsimile recorder at 48 rpm, in order that one revolution of the drum corresponds to one line of video. A light gun, containing a high intensity modulated light source focused to a small spot, will paint the picture on the photographic paper as the drum rotates. The light gun must be slowly pulled (or pushed) along the length of the drum to provide "vertical" scanning as the image is built up. This is accomplished by a small slow speed motor operating a threaded rod which engages a nut on the carriage assembly for the light gun. Proper operation of the system requires that the drum operate at precisely the line rate of the satellite video, so a synchronous motor is required. Although there are 48 rpm synchronous motors, they are difficult to obtain so a 60 rpm motor is operated on 48 Hz ac (instead of the normal 60 Hz) to obtain 48 rpm output.

During reception of a satellite signal, the satellite video is recorded on the right channel of a stereo tape deck while an accurate 4800 Hz tone, derived by a digital countdown chain from a 4.8 MHz oscillator, is recorded on the left channel. During picture display the satellite video from the right channel of the tape deck is filtered and amplified, and routed to a high level video driver to modulate the light gun. Output from the light gun is highest in black areas of the picture and lowest in white areas so the processed photographic paper will have a positive image. The 4800 Hz tone on the left channel is used to lock a phase locked loop (PLL) to 4800 Hz. The PLL output is divided to 48 Hz by a digital countdown chain and this 48 Hz signal is amplified by a high level class AB_1 amplifier to provide 48 Hz ac at 120 V to operate the drum motor at 48 rpm. Since the crystal controlled 4800 Hz tone was recorded simultaneously with the satellite signal, any variations in tape speed during playback will be "tracked" by the PLL and the ac driving the drum motor will shift in frequency to compensate, resulting in the maintenance of a stable sync condition despite flutter and wow in the recorder.

A word here about the recording process. Many of the earlier articles on satellite picture reception stated that "live" display was preferred to a recorded signal, in that the recorded signal was rarely equal to the "live" version. This may well have been the case several years ago but is no longer. Modern recorders of the "hi-fi" type, and integrated circuit PLL and digital countdown chains, result in a situation where there is no observable difference in quality between recorded and "live" picture display. Working from recordings is infinitely easier and will have no effect on picture quality.

Up until this point we have not mentioned picture phasing – alignment of the synchronized picture with the edge of the paper wrapped around the drum. The complete NOAA data display contains two areas of potential interest, the earth scan picture in the visible light channel and an identical

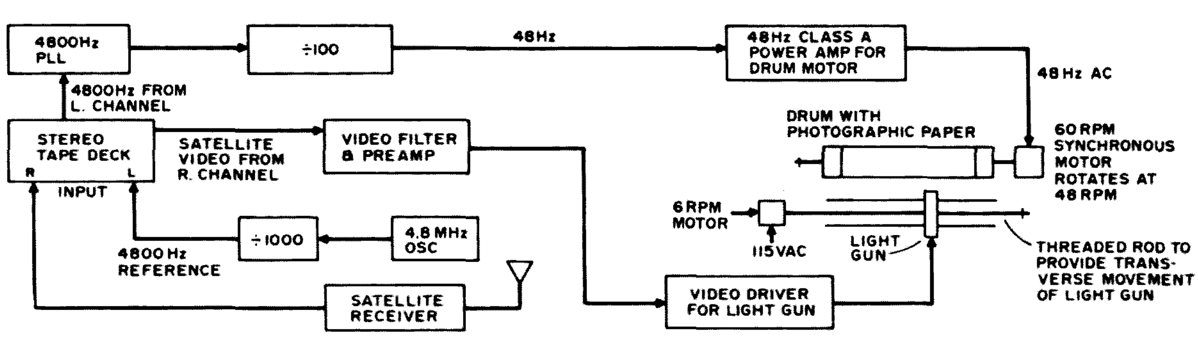


Fig. 1. A block diagram of the weather satellite facsimile system.

view as produced in the infrared waveband. Each of these earth scan images occupies 30% of the total length of the scanning line (circumference of the scanning drum). The remaining 40% of the line is taken up by space scan, telemetry, grey scale, instrument restore periods, and timing data, much of which is of little interest to us. At any given time we are usually interested in only one of the two images – visible channel during daylight passes and IR channel during evening passes. Thus, the image of interest on any particular pass occupies only 30% of the line length. This means that if we randomly slap paper on the drum, fire up the recorder, and print a picture, with no attention to phasing at all, the chances are 70% that the desired image will not fall on the point where the paper overlaps. This means that 70% of the time a usable picture could be printed with no attention to phasing. The other 30% represents situations where you would have to repeat runs or tape the complete picture from the overlapping paper ends.

There are two general situations where phasing is required. First, if you are a purist and want all the satellite data printed out neatly and uniformly, phasing will be required to correctly "place" the image on the photographic paper. Secondly, if you are using an oversize drum to increase picture size, and the stock paper size will not fit completely around the drum, you must phase to accurately align the desired part of the satellite image onto the portion of the drum which is covered by paper. The end of the construction phase will outline a very simple phasing system to accomplish precision alignment. The major disadvantage of phasing is that an external oscilloscope, or other CRT display, is required.

Solid State Module

The most critical functions in the system are performed by a simple module using ICs and other solid state devices. The circuit (Fig. 2) is simplified considerably by the use of several devices in more than one function,

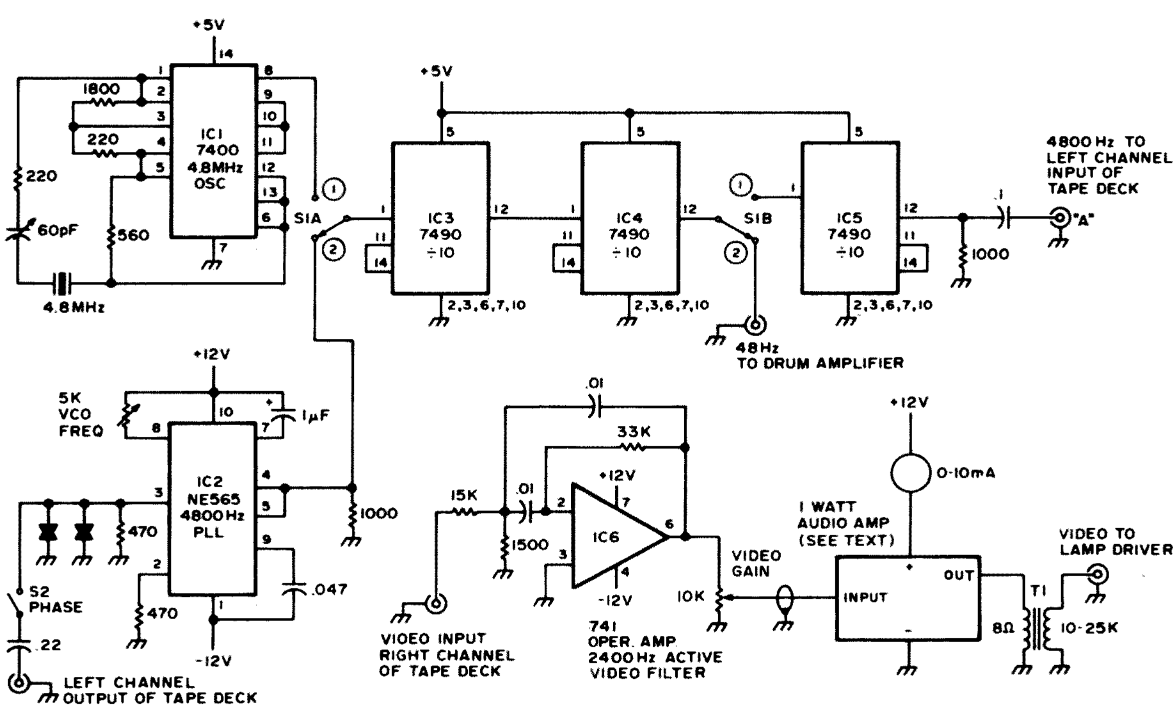


Fig. 2. Solid state module. All resistors ¼-½ Watt; capacitors are 1 V mylar. S1 – DPDT; pos. 1 for receive, pos. 2 for display. S2 – SPST for phasing, open for phase, close for lock and run. VCO frequency adj. should be set for a free running frequency (S2 open) of 4700 Hz at pins 4 and 5 of IC2. The 60 pF capacitor in the 4.8 MHz oscillator circuit (IC1) should be set for an oscillator frequency of 4.8 MHz or exactly 4800 Hz at output jack A with S1 in position 1. The 4.8 MHz crystal should be a precision series resonant AT cut – send the oscillator schematic with the order. Surplus crystals might be suitable provided you can get them on frequency. The better the crystal the better the long term stability of the reference source.

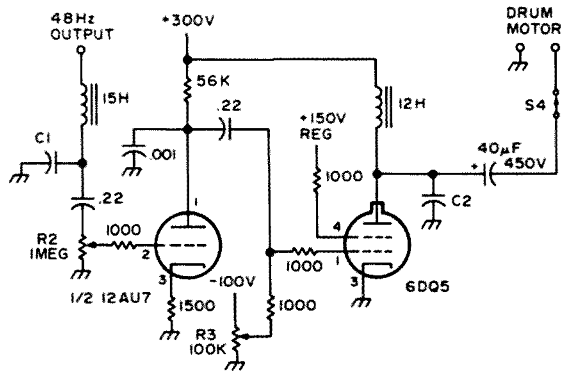


Fig. 3. Drum amplifier. Unless otherwise noted, fixed resistors are ½ W 10%; capacitors are disc ceramic; pots are 2 W composition. Within reason, any inductance can be used with the input and output chokes, as long as a suitable value capacitor is used to bring the tuned circuit to 48 Hz resonance. C1 and C2 should be mylar units and the required capacitance can be obtained by paralleling smaller values. With the choke values shown, C1 should be 0.7 mF and the individual capacitors may be 100 V units. C2 should be 0.9 mF, and 600 V units should be used. If other chokes are used, an LC of 1.1×10^{-5} at 48 Hz may be used to calculate the value of the capacitor required. The input choke may be relatively high resistance but the output choke handles power and thus should be as low a resistance as possible. Adjust R2 for 120 V ac at the motor when driven by 48 Hz. S4 – SPST – open to stop motor while changing paper, etc. R3 should be set for -50 V at the center arm. A fixed voltage divider may be substituted; calculate on the basis of the fixed bias voltage available from the supply in use.

notably the ICs in the divider chains. During satellite reception, S1 is in the receive position (1). IC1 serves as a 4.8 MHz oscillator whose output is routed to three successive 7490 decade counters (IC3-5) providing a total division of 1000. The output of the chain is a 4800 Hz signal that is recorded on the left channel of the deck while the satellite signal is recorded on the right channel. During picture readout S1 is in the display position (2). IC2 is an NE-565 PLL with a free running frequency near 4800 Hz. The pre-recorded 4800 Hz reference signal locks up the PLL, whose square wave output is routed through a divide by 100 countdown chain (IC3 and 4), providing a phase locked 48 Hz output which will be used to drive the drum motor amplifier. Satellite video from the right channel of the tape deck is routed through IC6 which serves as a 2400 Hz bandpass filter with a bandwidth of 1000 Hz and

unity gain. The filtered video signal is then routed to a small IC or transistor amplifier which serves as a preamp to drive the video amplifier circuits for the light gun. Any small 1 Watt audio amplifier will work here, including any of the many small transformerless IC circuits. I use a small discrete component amplifier from Radio Shack. Very little output is required into the coupling transformer (T1), and a small 0-10 mA meter in either the + or - supply line to the amplifier will provide an indication of video level. Virtually all of the small amplifiers available, whether IC or discrete, are class B, drawing very little current when idling and, when driven, having current roughly proportional to the drive level. Few devices are required for this module, and the whole circuit can be assembled on a small piece of perf board with 0.1" hole spacing to accommodate the ICs. Sockets are recommended for the integrated circuits so they will not be damaged in wiring up the unit. I have my module mounted in a separate cabinet because it is part of the CRT system

The main chassis of the FAX unit. The 12AU7 and 6DQ5 in the drum amplifier circuit are toward the back of the chassis, with the lamp driver circuits (12AU7 and 6CL6) along the front edge. T2 in the lamp driver chain is mounted below the chassis. The front panel meter (M2) monitors lamp current. The three toggle switches on the front of the chassis control the on/off functions of the drum motor, traverse motor and lamp. The cable to the light gun plugs into the top of the chassis near the 6CL6, while the power cables for the FAX recorder motors plug into connectors on the rear apron.

as well, but if FAX alone is desired it can be mounted on the same chassis as the tube circuits to be described.

Drum Motor Amplifier

Fig. 3 shows the class AB_1 amplifier used to power the drum motor. Although a solid state circuit could be used for this purpose, I decided to go the tube route and use an existing supply. There is nothing original about the circuit – it's cribbed from marginal notes on a letter from W6WMI. The circuit is straightforward and trouble free. A 15 H choke and capacitor, resonant at 48 Hz, distorts the square wave (from the solid state module) to a good sine wave, and drives ½ of a 12AU7 and a 6DQ5. The 6DQ5 output stage is resonant at 48 Hz and drives the drum motor windings through a 40 mF coupling capacitor. The input level to the 12AU7 is adjusted to provide 120 V ac to the motor windings. The filament voltage, bias voltage and 300 volts are obtained from my SB-102 power supply. You can build a separate supply of course, but if a suitable supply is already available a new power cable is certainly cheaper then what they are asking for power transformers these days. The regulated +150 volts can be obtained from the 300 volts via a 5k Ohm 8 Watt dropping resistor and an OA2 regulator.

Lamp Driver

Fig. 4 shows the lamp driver circuit which operates a glow modulator tube in the light gun. The circuit is a modified version of a circuit described by Ruperto in a recent Amateur Scientist section of Scientific American (Jan. 74). The original circuit was designed by W6KT. In my version, the filtered hi-Z video from the solid state module is fed to a 12AU7 with its triode sections in parallel. The 12AU7 drives T2 with the full wave diode detector circuit in the secondary. The detected video is filtered to remove 4800 Hz components (resulting from full wave detection of the 2400 Hz satellite video subcarrier) by the 88 mH toroid and associated capacitors. The filtered waveform, now containing only video components, is fed to a 6CL6, which drives a Sylvania R-1168 glow modulator tube in the light gun. A meter in series with the lamp provides an indication of lamp current. The polarity of the video detector diodes results in maximum amplitude from the glow tube in black picture areas and minimum amplitude in white areas. The black level, maximum lamp current with no video input, is set by the 250 Ohm pot in the cathode circuit of the 6CL6.

Both the drum amplifier and the lamp driver can be assembled on a single chassis (see photo) along with the 150 volt VR tube. The modest power requirements of the unit are easily met with a transceiver power supply.

Drum Size and Motor Requirements

Synchronous motors are used in the facsimile recorder to achieve the required accuracy in all of the phases of picture display. Such motors are available in a

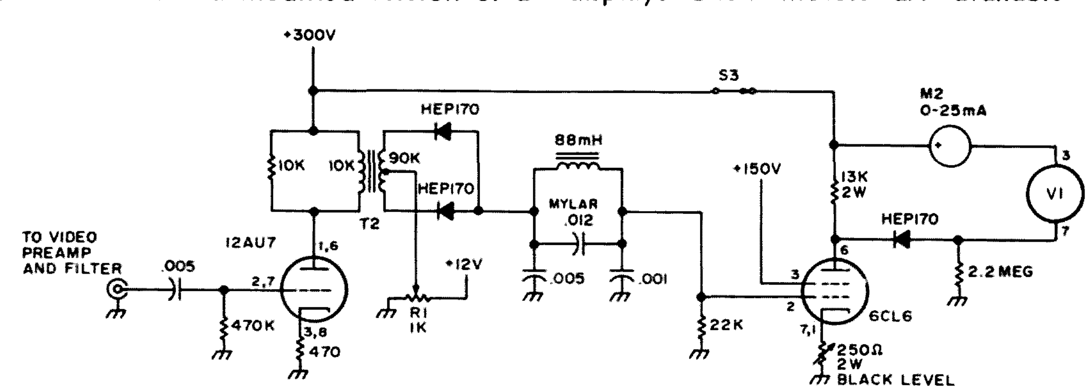


Fig. 4. The lamp driver circuit. Unless otherwise noted, all fixed resistors are ½ W 10%; capacitors are disc ceramic; pots are 2 W composition. R1 – start with +2.4 V on T2 centertap. Black level – adj. for 10-20 mA of lamp current (M2) with no video input. Exact level depends on paper used (see text). The 0.012 mF capacitor can be made up by paralleling 100 V mylar units of .01, .001, and .001 mF. See set up instructions for input level adjustment. S3 – SPST – turns off the lamp on standby.

Drum Diameter (inches)	Design rpm	Drive Motor Selection	Earth Scan Width (")	Picture Length (10 min. display)
2.0	6.9	6/60	1.9	3
2.25	7.7	8/60	2.1	4
2.5	8.6	8/60	2.4	4
2.75	9.5	12/48	2.6	4.8
3.0	10.6	10/60	2.8	5
3.25	11.0	10 or 12/60	3.0	5 or 6
3.5	12.0	12/60	3.3	6
3.75	13.0	12/60	3.6	6
4.0	13.8	12/60	3.8	6
4.25	14.7	20/48	4.0	8
4.5	15.5	20/48	4.3	8
4.75	16.4	20/48	4.5	8
5.0	17.1	20/48	4.7	8
5.25	18.0	20/60	5.0	10
5.5	18.9	20/60	5.2	10
5.75	19.8	20/60	5.4	10
6.0	20.6	20/60	5.7	10

Table 1. Traverse drive motor requirements and picture geometry for various drum sizes. The design rpm is the calculated rpm, driving a 20 turn per inch threaded rod, to achieve the proper aspect ratio. The drive motor selection shows the stock motor speed and drive frequency (Table 2) that comes closest to the design figure. The picture width indicates the width of the earth scan image in either the visible or IR channel, and the picture length is based on a ten minute pass. A 15 minute pass would result in an image 1.5 times longer, 20 minutes, 2x, etc.

variety of sizes from small units of 3 Watts or less, used for timing devices such as clocks, to very powerful units. We want motors with sufficient torque to carry out the operations required, but it doesn't pay to go to excessively large motors, particularly in the drum drive, since they would put too high a load on the drum amplifier. Motors rated between 100 and 150 inch/oz. of torque (ratings based on 1 rpm) are about right. It is also desirable to have motors that are reversible. With the recorder built according to the diagram in Fig. 5, if the drum motor turns the drum counterclockwise the light gun should move from the right end of the drum to the left in order to print out the picture. With a standard right hand thread on the lead screw rod this means the traverse motor should also turn counterclockwise. If reversible motors are used, once the first picture is finished both motors can be reversed (clockwise) and a picture, with the correct orientation, can be printed out going back from the left end of the drum to the right. Once that picture is finished, the motors can be reversed again to print another picture in the same direction as the first. Hurst series DA synchronous motors, available from distributors such as Allied, are ideal since they are reversible with a SPDT switch and are rated at 150 inch/oz. torque. If a 60 rpm Hurst motor is operated on 48 Hz ac, the drum will turn once for every line of video, causing the visible and IR images to be displayed side by side. The drum size is all important in defining the remaining parameters of the system for in order for the picture to have the proper appearance the light gun must traverse the drum at a speed proportional to the drum diameter. If the traverse rate is too slow for the drum size in use, the picture will be too short in relation to its width, distorting clouds and other features. If the rate is too fast the picture will be "stretched" vertically, again distorting the proper aspect ratio. Since we standardize on the use of a 20 turn per inch threaded rod in the traverse assembly, the only variable in achieving the proper traverse speed with any

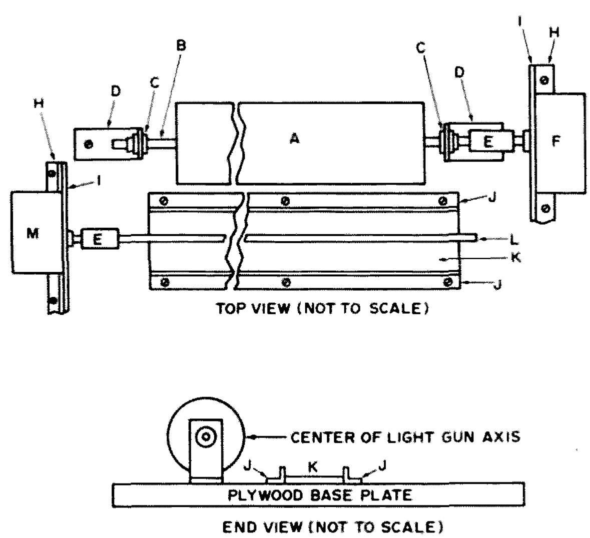
60 Hz rpm	48 Hz rpm
6	4
8	6.4
10	8
12	9.6
20	16
30	24
60	48 (use for drum drive)

Table 2. Standard Hurst DA series, 150 inch/ounce synchronous motors (reversible) showing their operating speeds (rpm) on 60 Hz (normal) and 48 Hz ac. When ordering, specify the 60 Hz speed.

particular drum size is the rpm of the traverse motor.

Without going into the calculations (which I will gladly supply to anyone who sends an SASE), Table 1 shows the design rpm required for different drum sizes so the resulting pictures will have the proper aspect ratio. Let's say you pick up a nice rolling pin from your local store and find that it measures 2.5" in diameter. According to Table 1, the proper rpm for the traverse lead screw would be 8.6. Fine, now just try to find an 8.6 rpm synchronous motor. As we can see in Table 2, the standard Hurst speeds (available from Allied) are 6, 8, 10, 12, 20, 30 and 60 rpm. No 8.6! The closest we can come is the 8 rpm unit (listed in the motor selection column of Table 1), which will do the job without producing enough distortion to notice. Let's take another example. Assume a drum diameter of 2.75". The proper design value is 9.5 rpm. If we look at Table 2 we see that a 12 rpm motor, operated on 48 Hz instead of 60, will give an output speed of 9.6 rpm; the motor selection column in Table 1 thus calls for the 12 rpm motor operated on 48 Hz. We would simply hook the motor to the output of the drum amplifier, just as we do for the drum motor. If the motor selection column calls for the use of 48 Hz with any particular motor, the drum amplifier should be used as the ac source, while if 60 Hz is required the normal ac line may be used. Table 1 should be used to pick the proper traverse motor for the drum size you plan to use.

The additional factor which is determined by drum size is the final picture size. The



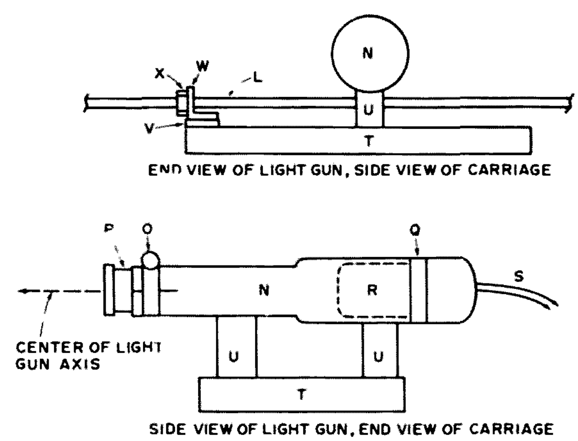


Fig. 6. Light gun and carriage details.

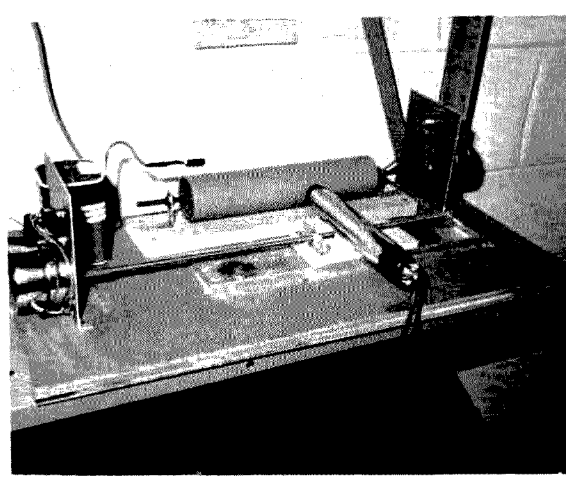
Fig. 5. General views of drum, motors and carriage track.

Key to elements of FAX diagram (Figs. 5 and 6):

A – drum, plastic rolling pin, or other material.
B – ¼" steel rod – epoxied to drum.
C – cut down (shortened) 3/8" panel bushing for ¼" shaft, used as bearing.
D – steel angle brackets mounted to base plate.
E – stiff rubber coupling from drum shaft to drive motor.
F – 60 rpm synchronous motor for drum drive.
G – not used.
H – ½" aluminum angle bracket to fasten motor mounting plate to base.
I – 1/16" fiberglass PC stock for motor mounting plates.
J – ½" aluminum angle stock screwed to base to form carriage track.
K – glass plate epoxied to base between rails.
L – ¼" 20 threaded rod for carriage drive.
M – synchronous motor for carriage drive (see text for speed).
N – 1¼" flared plumbing fitting for body of light gun.
O – hose clamp to lock lens into the slit end of the light gun.
P – standard 1¼" telescope eyepiece for focusing light beam.
Q – octal socket and shell for glow modulator tube.
R – R-1168 glow modulator tube, slide fit into large end of flared tubing.
S – flexible leads from glow tube socket to main chassis.
T – wooden base of carriage assembly.
U – wooden supports for light gun – epoxy to tube.
V – double stick foam mounting tape.
W – ½" aluminum bracket stock to support traverse nut.
X – ¼" 20 hex nut epoxied to support bracket.

2.5" diameter drum mentioned previously will print out an earth scan image in both the IR and visible light channels that is 2.4" in width. The length of the image will depend on how much of the pass is displayed – Table 1 assumes 10 minutes. For a 10 minute pass with the 2.5" drum, both the IR and visible channel images would measure 2.4 x 4 inches – about the size of a Polaroid print. With the light gun system described, the images should be perfectly clear with well defined line structure under high magnification. Rolling pin style drums permit two passes (10 minutes each) to be displayed on a single 8x10" piece of photographic paper.

If you simply must have larger pictures, there are two ways to go about it. The first involves running the drum at 96 rpm (a 120 rpm motor on 48 Hz) and electronically blanking out alternate lines of video so that only the visible or IR image is displayed. The traverse motor speed for the lead screw must also be doubled for this approach but the picture comes out twice the size. If only visible channel data are desired, the line blanking is not required due to the pronounced level difference between the visible and IR channels, and you will obtain a larger picture with the small drum format. The second method is simply to use a larger drum. The largest size covered in Table 1 is 6" in diameter. The image width in this case would be 5.7" and its length, for ten minutes, would be 10", about as much picture as can be packed in an 8x10" sheet of photograph paper. With a drum this large the paper will no longer cover the entire surface, so in effect, depending on how you phase the picture, you will be printing only the IR or visible image unless you use oversize paper. Larger drums can be made from almost any cylindrical material including metal juice cans, cardboard tubes, or custom fabricated assemblies. The height of the drum bearings and the height of the light gun must of course be adjusted to your drum size. The only requirement in fabricating a larger drum is that it must turn true when mounted on its shaft; otherwise, portions of the paper will be out of focus as the drum wobbles. Fig. 5 shows a diagram of the drum and traverse assemblies and Fig. 6 the details of the light gun and carriage.



The author's FAX recorder. The relationship of the various parts should be clear. The reversing switches and capacitors for the Hurst motors are mounted on the motor mounting plates. The reed switch and battery used for picture phasing (see text) are also shown.

Next month: Construction and set up.

. . . WB8DQT

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Where is your simplified, sensitive millivoltmeter?

Here's a practical instrument suitable for home construction which is based upon an integrated circuit (NATIONAL type LM 4250 C). Switched ranges of 5 mV to 500 V are provided.

Construction

Layout has not proved to be critical in the prototype but input leads and associated switching have been kept compact; 2% tolerance resistors have been used throughout. Initial zero adjustment on the 5 mV range is set by selection of Rb in association with potentiometer R2 which is used for fine control. No zero drift has been observed on the prototype even on the most sensitive range.

An internal calibration check is provided on the 5 V and 50 V ranges by a push-button connection to the positive supply rail. This facility is used to adjust the meter deflection initially to 1.4 V on the 5 V range by means of pre-set resistor Rm. The value of the associated fixed resistor rf may also be varied if found necessary to suit the internal resistance of the meter used.

A miniature main switch serves to reverse the input polarity when required. The power

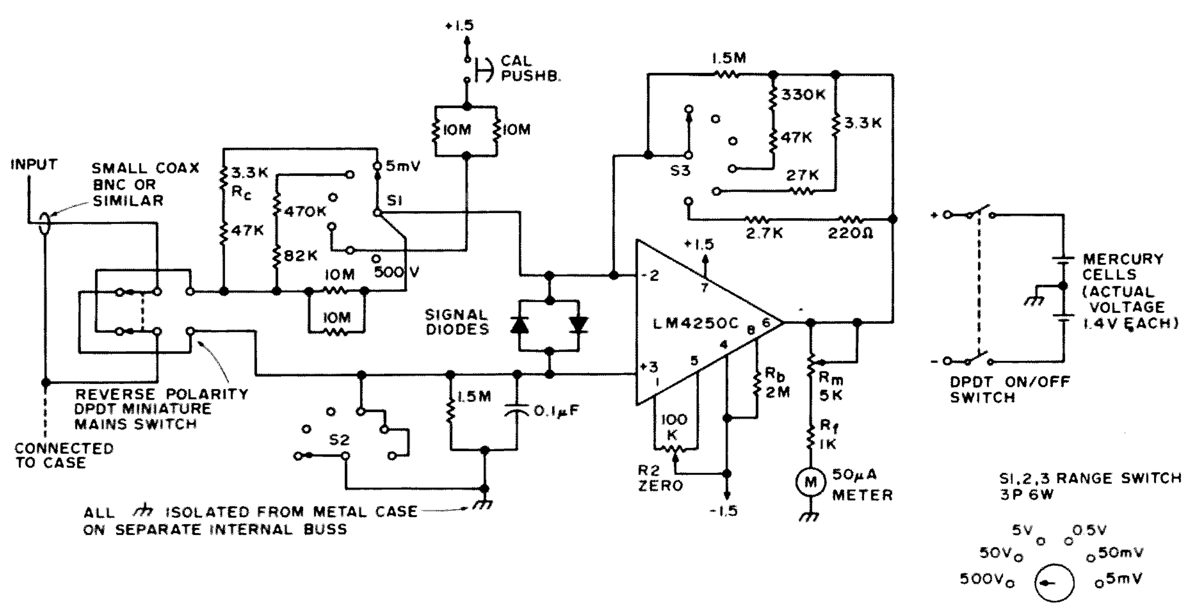

Fig. 1. Circuit diagram.

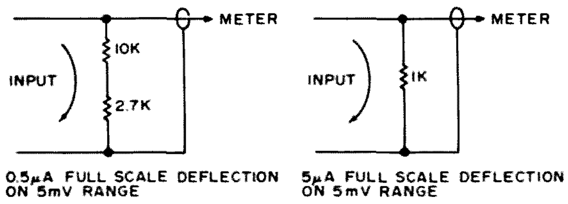

Fig. 2. External shunts.

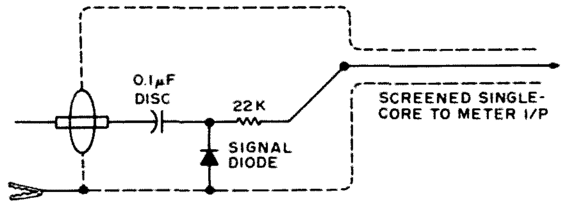

Fig. 3. Rf probe.

supply comprises two mercury-button type cells (ER 675) contained within a small paxolin tube, spring loaded to maintain contact pressure. Other options are possible, of course. Consumption is minimal, being approximately 60 microamps for full-scale deflection. The unit is housed in an aluminum die-cast box.

Input impedance is approximately the value of Rc for the range concerned, shunted by the input-lead capacitance (approximately 50 k to 5 megohms, according to the range used). Overload protection is provided by two back to back signal diodes. Repeated application of 30 V dc on the 5 mV range has had no detrimental effect on the prototype. External shunt resistors may be used to monitor dc currents down to quite low values. Fig. 2 gives examples scaled for measuring 5 microamp and 0.5 microamp full scale deflection on the 5 mV range.

Rf may be measured by the use of a suitable probe (see Fig. 3). The approximate input impedance of this device is 6 k at 2 MHz falling to 1 k at 25 MHz. The probe is usable to about 100 MHz.

Application

Since the instrument is sensitive and self-contained, it lends itself to a variety of tasks, some beyond the means of conventional multimeters. The very low power consumption means that battery life is very near shelf life.

The ability to read currents of less than a microamp enables diode and semiconductor device reverse and leakage currents to be read. With the millivoltmeter suitably insulated EHT tube currents can be measured (CRTs).

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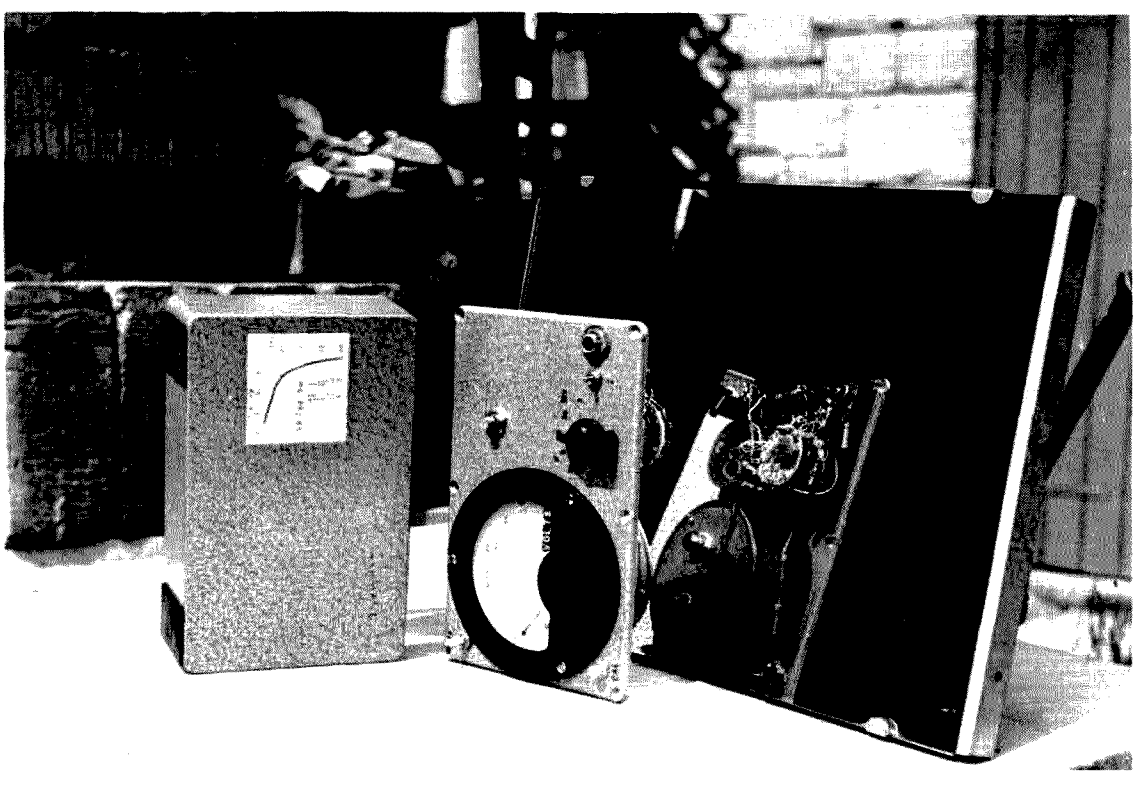

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Three Button TT Decoder

In the process of designing a digital control system for our Touchtone entry repeater, it became necessary to come up with a simple system to recognize Touchtone groups. I decided upon a three button code for all functions as a compromise between ease of "dialing" and number of operations possible. The system described here is very simple and allows automatic cancelling as well as security for the control functions.

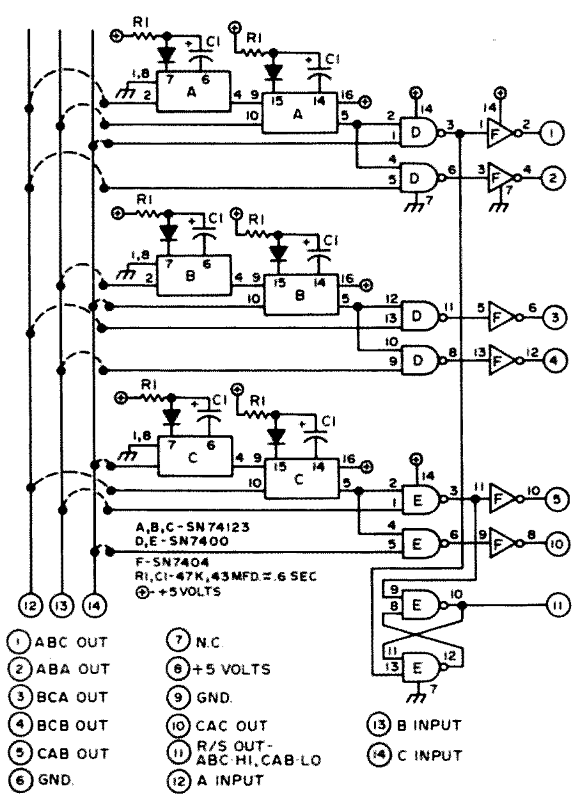

Fig. 1. Schematic.

The building block of this system is the TTL dual monostable multivibrator, SN74123. With only three external components each monostable yields a pulse of predetermined length for a short pulse initiated by the Touchtone decoding system.

Two of these monostable multivibrators (one IC package) plus two dual input NAND gates can be used to produce an output pulse upon the reception of the correct three Touchtone signals. My needs for the rest of the control circuits force me to include an inverter after each output yielding an output of a positive (TTL level) pulse whenever the correct combination is received.

There are 3 sets of decoders on each card in my control system. The whole card diagram is seen in the schematic diagram, Fig. 1. There were two dual input NAND gates leftover in the packages required so they are wired as an r/s flip flop. As shown in Fig. 1, the output from this flip flop will be positive upon receipt of a combination in the order of A–B–C and will remain positive until a combination in the order of

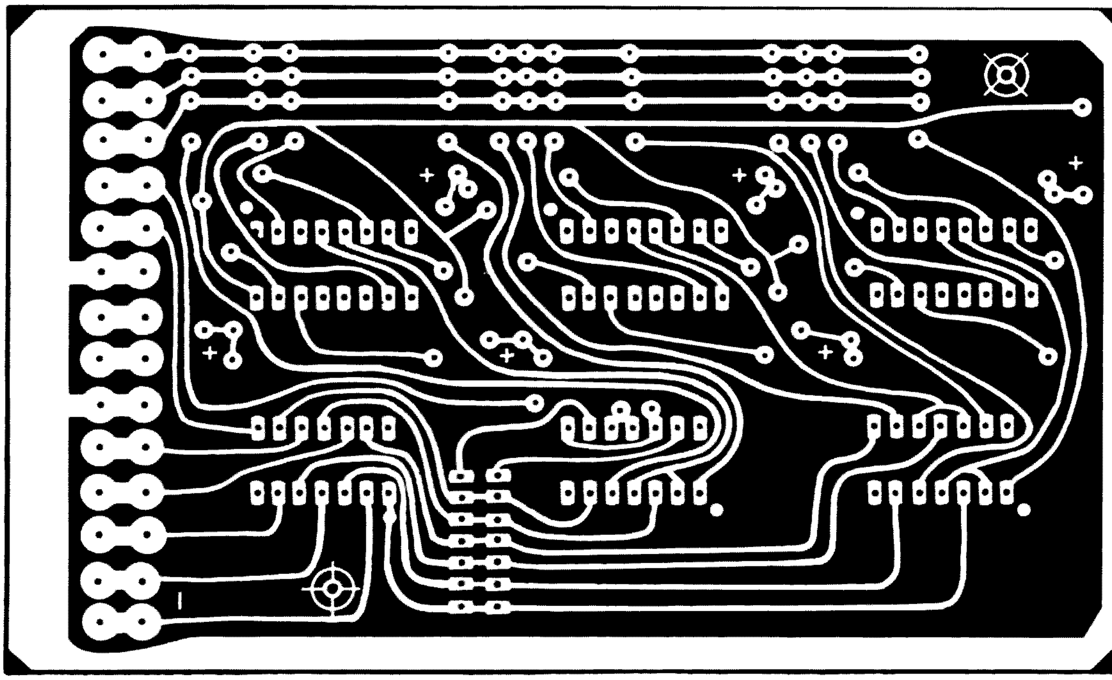

Fig. 2. PC board, foil side (full size).

C–A–B is received. Its state will then change to near ground and remain there until A–B–C is again received.

In our repeater system the tone entry is opened by transmitting 4–8–#. Therefore, the 4 = A, 8 = B, # = C. We can see from this that the r/s flip flop will give a positive output when the tone entry has been opened and will return to the ground state when #–4–8 has been transmitted. While the tone entry automatically closes after one minute of inactivity, it can also be manually closed using this code.

By changing the three inputs to this card and the jumpers to individual decoders, any combination of three may be selected with one exception, which is that no two adjacent inputs may be the same. In our example, #–#–8 would not be an acceptable combination, but #–8–# would be perfectly OK.

If we look at one of the sections of the decoder we may be able to get a better understanding of its operation. The monostable multivibrators, as mentioned before, will give an output for a predetermined length of time when they receive a change of state of their input. They have provided inputs of both polarities and outputs which are complementary. The first monostable, in this system, must give an output when a transition from ground to positive is received. Therefore, the inverting input to the IC, pin 1, must be grounded and the non-inverting input, pin 2, is connected to the A input of the decoder. Pins 6 and 7 are connected to the timing components. The normally positive output, pin 4, is needed as an input to the next monostable. This output will remain low for a fixed period of time (about .6 second for the example shown). During this time the next input must have been selected. If it has not been, the process is automatically cancelled and must begin again if an output from this decoder is to be indicated.

If the second input, B, is selected during the low time, the inverting input, pin 9, of the second monostable is held low by this output from the first monostable and its non-inverting input, pin 10, is raised to positive by the B input. This will permit a change of state at its outputs. The timing components are the same as the first monostable. This output, the normally low one this time, pin 5, can only result when the first two numbers have been transmitted within the preset length of time. This output also will remain for only about .6 second. So the final tones must be transmitted within this time period or the operation is cancelled and must begin from the beginning.

If the C or A is received within this final period, its respective NAND gate will see

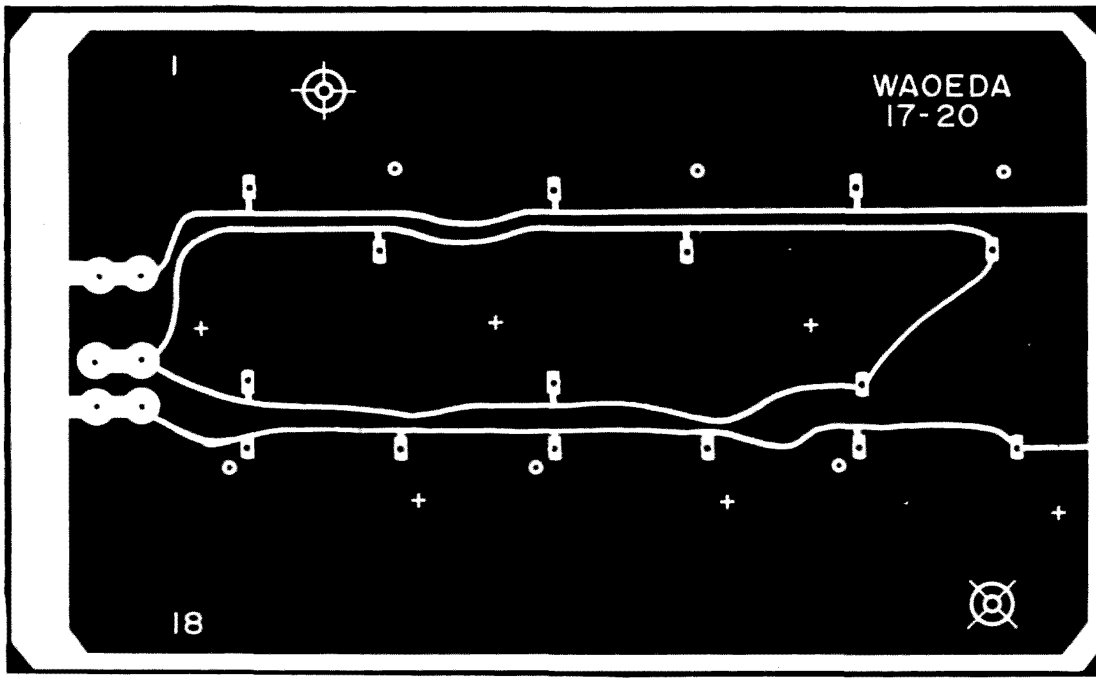

Fig. 3. PC board, component side (full size).

two positive inputs and will give a resulting low output while the second monostable remains in its ON state and the final input is being received. The second NAND gate was used as a cheap and easy way of getting two control functions with only the addition of one NAND gate. These outputs are inverted and are used to control the repeater functions.

This system was designed by me and has been in operation in our 13/73 repeater, WRØABO, since we received our license in July, 1973. It is the only part of the system which operated perfectly from the first and has developed no problems. The .6 second dialing requirement has caused few problems and is very convenient when a wrong number is pressed. The operator must only wait for a second and then begin to dial again. The control functions which must remain secure are protected by the fact that anyone pushing buttons at random must press the correct combination in a very short period of time. Also, the system is easily changed to a different combination in case any unauthorized person learns the control codes.

A printed circuit layout is included and does require a dual sided circuit board. Many methods of decoding patterns of dialed digits exist but this seems to be the most practical for a reasonable number of functions. I would guess the price of components to decode two combinations (e.g., A–B–C and A–B–A) to be less than $2. All components are readily available from distributors advertising in 73.

. . . WAØEDA

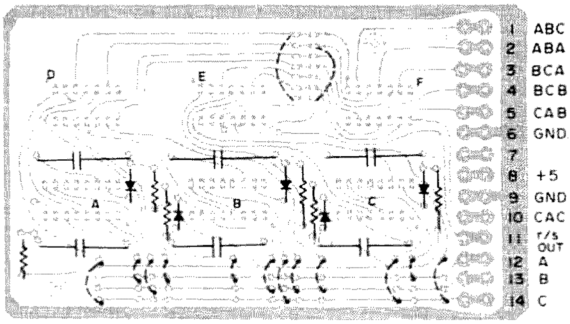

Fig. 4. Component layout, foil side.

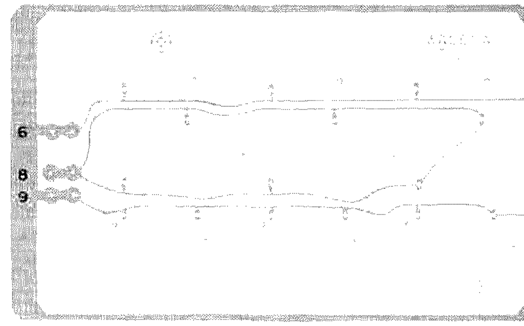

Fig. 5. Component layout, component side.

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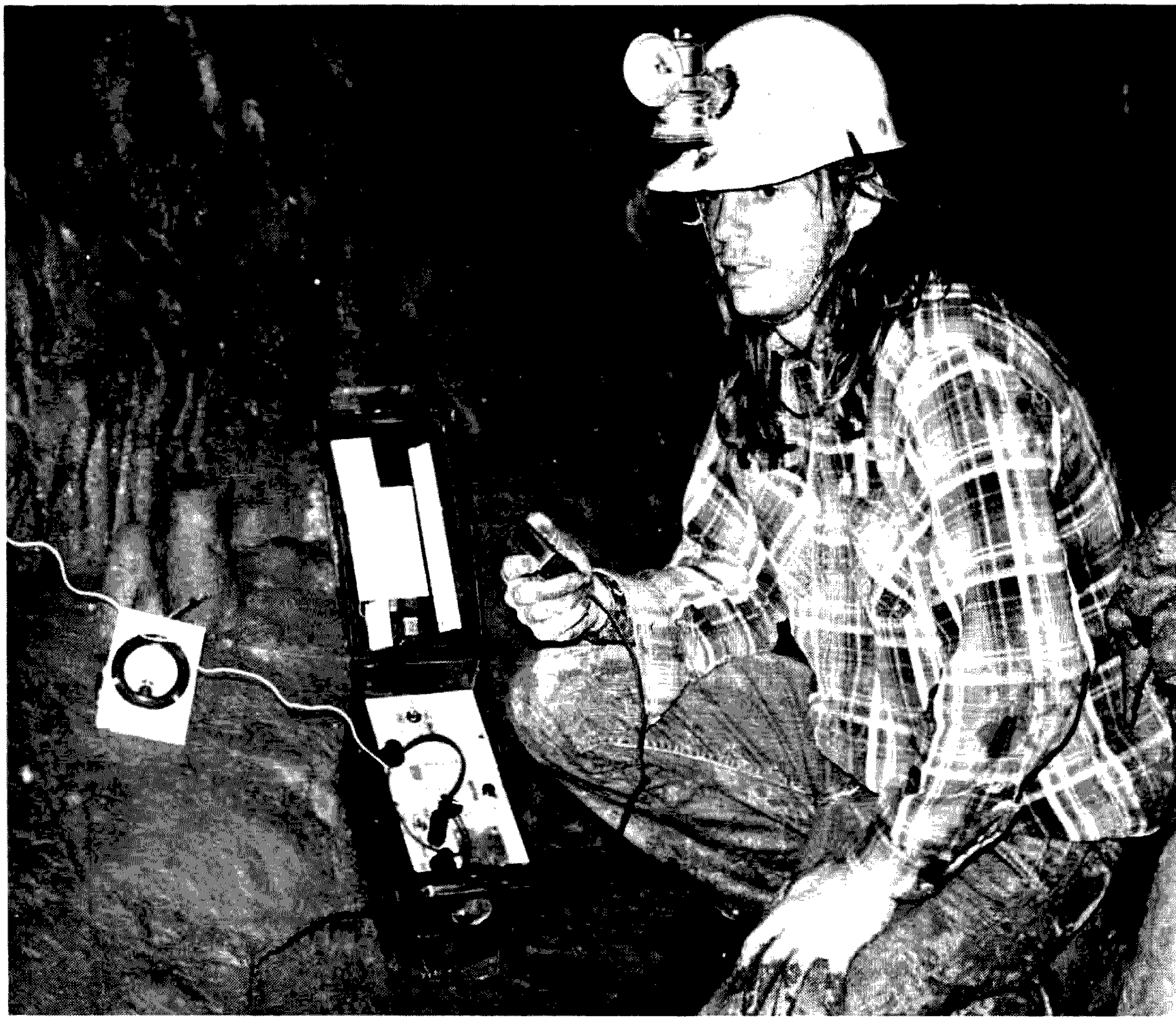
Underground Radio is Dirty Business

Can radio really work underground?

An underground radio system, one that can be used to communicate in caves, has fascinated me for a long time. Out of this fascination grew the basis for this unique experiment. A cave presents difficult barriers to overcome in its exploration. Tight crawl-ways, pits, mud and water are only a few. Many cave passages are measured in miles, with hours being required to explore them.

While many explorers or "cavers" will disagree as to their often masochistic reasons for enduring such sufferings required to explore caves, most will agree that one of these imposing barriers is isolation – isolation in the form of separation of an exploring party from the people back on the surface, or from another group within the cave. It is a form of isolation hard to comprehend in an age of instantaneous communications, for in a cave communications is generally only as fast as an explorer can travel. Or at least it was until we began these cave-radio experiments. But before going on, let me give you an idea what exploring a "wild" cave is like, one without electric lights, pathways or guides.

An explorer pauses a moment to smile at his companions, and then silently rappels down a rope into a deep black hole. His miner's lamp is all that relieves the total darkness of the pit. While the others watch, the light grows smaller as he descends until it is no more than a speck far below. Several hours of tortuous climbing behind them, the summer sun blazes on a hot dusty afternoon.



Operating KA2XAR mobile unit 1 in the depths of a wet, muddy cave is Bill Madden. He's operating on 1545 kHz, 10 W input, AM modulation. (Photo by James McCloud)

But deep within the cave, the explorers quietly shiver as they wait in the cold mist of a waterfall for their turns to descend. Far below a voice calls out that he is safely down. Now another explorer prepares to enter the pit.

As you can see, in a cave man is the alien in an often hostile environment. Constructing a communications system that would both communicate through rock, and withstand this environment, is quite a challenge. In the past, the systems used in caves had been almost exclusively army-style field telephones. However, the difficulty of stringing wire made their use prohibitive in all but extensive, large group expeditions. Induction radios operating in the range of a few kilohertz have been used with a varying degree of success, but their range is severely limited. What I and others wanted was a system that could be used like a walkie-talkie, one that could communicate up to several thousand yards between a "base station" on the surface, and portables located within the caves. The portable unit had to be idiot proof, for the last thing someone covered with mud and water wants to do is tune up a rig in the semi-dark. They also had to be designed to withstand being banged against rocks, pushed, dragged and tossed through mud and water as well.

In building up a system, the choice of a radio frequency was the main obstacle since experiments have shown that the lower the frequency, the better the range of a radio signal through the cave rock (in this case, limestone). Unfortunately the antenna size vs. efficiency of a portable unit makes some sort of compromise necessary. A few simple experiments convinced us that the .2 to 6 MHz region offered a good compromise frequency range in lieu of anything lower.

But just *how* good? How could the system be tested legally to see if it would work under actual field conditions?

Out of this curiosity was born KA2XAQ/KA2XAR. We were fortunate enough after exhaustive detailing of the proposed experiments to obtain an experimental license from the FCC under Part 5. We asked for and were given permission to operate on a number of frequencies from 185 kHz to 27 MHz during September and October, 1973. KA2XAQ was assigned as our "base station" call and KA2XAR was the call sign to be used by the portable units which would be carried into the cave. The FCC classified the equipment as experimental or "laboratory constructed." That is to say, homebrewed. Our surface units were conventional ham type tube equipment scrounged up and brought to operation on our new frequencies at the specified frequency tolerances. The in-cave portables were all solid state and built into surplus army 50 cal. ammo boxes to make them both rugged and waterproof. These portables ran between 2 to 10 Watts input into antennas that could vary in length from a few feet to over 60 feet in length.

The tests were carried out in a large West Virginia cave located in the northeastern part of that state. The results? Much better than expected. For one thing, it was found that the use of frequencies below 1 MHz was unnecessary. The desired communications distance could be achieved at higher frequencies, with the best between 1-2 MHz. Above 2 MHz, the distance drops off quickly until at 27 MHz it is only a hundred feet or so at best. It was also decided not to use .2 to 1 MHz range because of antenna tuning problems and general inefficiency of our portable units at these frequencies. Redesigning them might overcome this, but for the present the higher frequencies suits our purposes providing communications in excess of 1000 yards. The equipment proved to be rugged enough to withstand numerous abuses, simple enough for an inexperienced operator, and virtually 100% reliable up to its range-distance limit. We strongly feel that building more sensitive receivers and better portable antenna systems will increase the system's performance, but for now, the isolation factor in cave exploring isn't so pronounced as before.

... WA3AQS

Left to right are Gale Hiem and Lynn Wayshner, operating KA2XAR mobile unit 2 on 1545 kHz. (Photo by James McCloud)

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What's Wrong with my SSTV?

Slow Scan TV operators often have difficulty describing the various types of interference experienced in picture exchanges. This article is intended to fill that void and hopefully rectify reports of "your pictures were not very good" to more specific analysis like, "your pictures have perfect sync, but noise in the video is excessive." Also, I would like to suggest some references on picture quality so we will be closer to an established system, like the RST system is for CW. Before discussing some picture specifics I would like to point out that photographs usually show up details the eye misses. Also, since we are dependent on the relationship of monitor dot intensity to camera F stops, photographs often reveal shadows and unequal illumination not noticed when viewing pictures on the monitor. These photos will also appear more

Photo 1.

Photo 2.

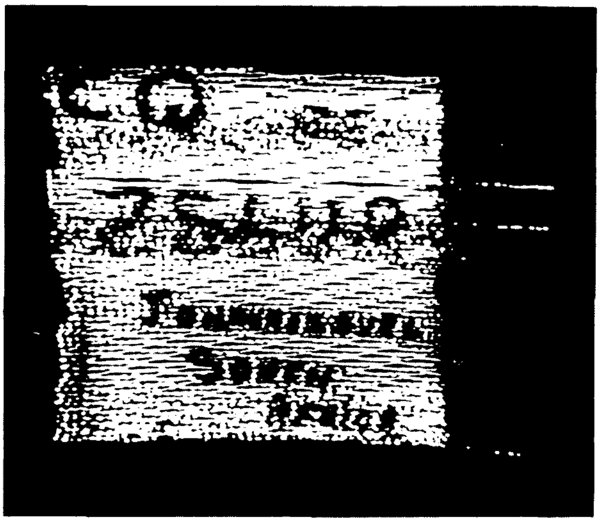


Photo 3.

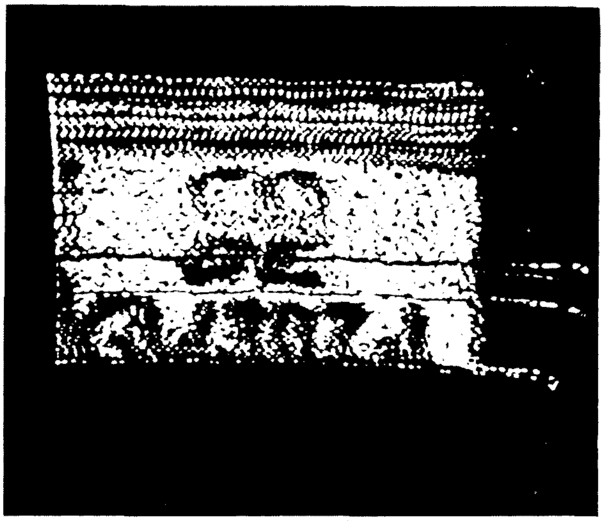


Photo 4.

natural on a monitor if you will view them at arm's length, rather than trying to "read" them closely.

Let's start our discussion with a solid "closed circuit" example as in Photo 1. Notice every line starts and stops exactly, resulting in a perfect raster. No interference of any type is evident and there are no skewed lines. The apparent gray scale limitation in the photo was only because monitor intensity was low to avoid "bleeding" on the photographs. When I made this shot, I was wearing photogray lens glasses which the monitor shows as regular glasses and the camera caught as sunglasses. (Pardon the bit of humor in the triple exposure picture.)

Next is Photo 2, which was received from FG7XT on Guadeloupe. This one may be considered very good and nearly closed circuit. There are a few missed lines right above the ID. These lost lines are due to intermittent QRM which overrode the sync pulses during that time period. Notice the otherwise perfect syncing and no noise in the video. If you look closely you'll see the circles are made up of the Slow Scan's 120 lines, not dots as one might think at first glance. The jiggled letters in "television" are due to a minute speed variation in my cassette recorder. The batteries were slightly weak and of course this is more noticeable with speeds like 1-7/8 ips (compare with Photo 1).

Now we move to Photo 3, which was received from ZS6UR in Johannesburg, South Africa, via 20m. He was only S3 and QRM was rough. QRM appears in the video as dots. This is noticeable immediately below the CQ and around the UR in ZS6UR. Accurate syncing is still maintained, as noted by the neat right side. Although ZS6UR was readable on the monitor screen, the camera caught more of the white dots around the UR, making all the ID difficult to distinguish. Notice you can read the QTH, which shows fair resolution for a "long haul" QSO. This picture could probably be considered between fair and poor in picture quality.

Photo 4 is very close to nil. If you hold it back and study it carefully you can just make out CQ de GW3DZJ. QRM in the video is very predominant above CQ as are some missed lines (due to QRM causing loss of sync pulses). There are some missed lines also through the DE, and QRM completely overrode sync at the ID bottom, resulting in no trace for the remainder of that particular frame. Readable, but definitely a poor quality picture.

We should term Photo 5 an uncopyable

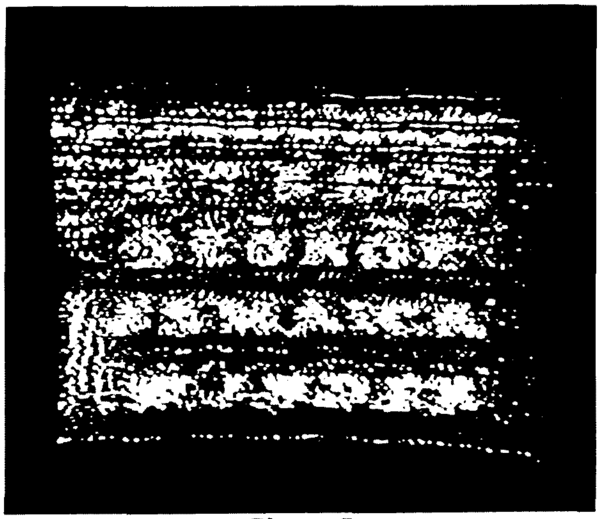


Photo 5.

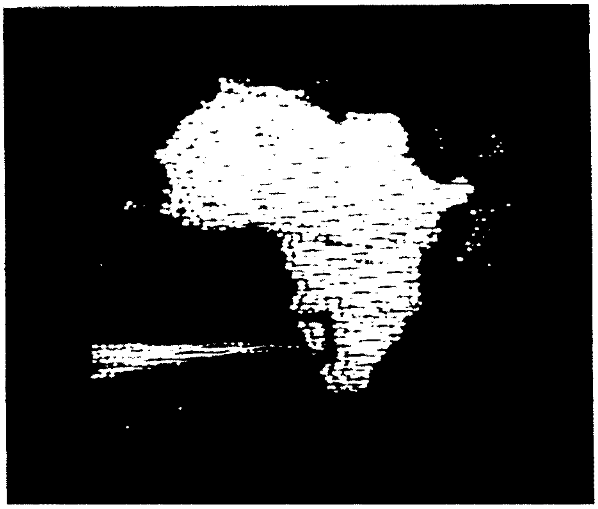


Photo 6.

picture. If you study carefully the middle of the picture, you can make out George, Jamaica. However, everything else was lost in noise and QRM, both in sync and video. This picture does point up a slight advantage when using white letters on a black background. If conditions were slightly better the picture would have made it; however, a white raster with black letters would probably still have been indistinguishable.

Photo 6 is very interesting in the fact it exhibits (among other things) an unusual form of multipath propagation. Ordinary (?) additive multipath usually appears as "ghost" in the received picture while subtractive multipath may cause a loss of part or all of the picture . . . you might hear it but not see it. Subtractive multipath is similar to an out of phase situation. If the negative phase of a signal equals the positive phase, the two cancel and no signal remains. In Photo 6, the multipath appeared to

Photo 7.

Photo 8.

manifest itself only in the higher video frequencies, causing partial cancellation in white. This is evidenced by "dots" in white (most noticeable near the bottom). This looks similar to QRM in the video. However, when this picture was received from ZS3B one night on 20m, he was the only station being heard (S8) and there was no QRM. His voice had a "DX echo" which denoted multipath, so this was the obvious answer.

Photo 7 is also "closed circuit" like Photo 1. Indeed there is nothing missing from this picture (!). Skewed lines are visible running from the top left to the bottom right and these are due to the playback tape recorder running slightly slower in speed than the recording tape recorder. If it had run faster, there would be skewed lines from top right to bottom left like Photo 8, and if the two speeds were identical, no skewed lines would be visible. If you will notice the absolute top line on your Slow Scan monitor you will see 4 very slight "waves." This is 15 cycle hum (60 cycles divided by 4). Now if speeds vary, these "hum bars" will displace on subsequent lines causing the "leaning" lines visible in Photos 7 and 8.

Photo 8 was accomplished by syncing the monitor externally to 15 cycles, then feeding in the Slow Scan picture. This resulted in the horizontal sync pulses being displaced just enough to be seen on the photo's left side. If you measure the sync pulse (although it is blacker than black, it only appears as black) which was approximately 6 ms wide, and then compare this with the picture's width, you will see it is approximately 1/11 the picture width, which means

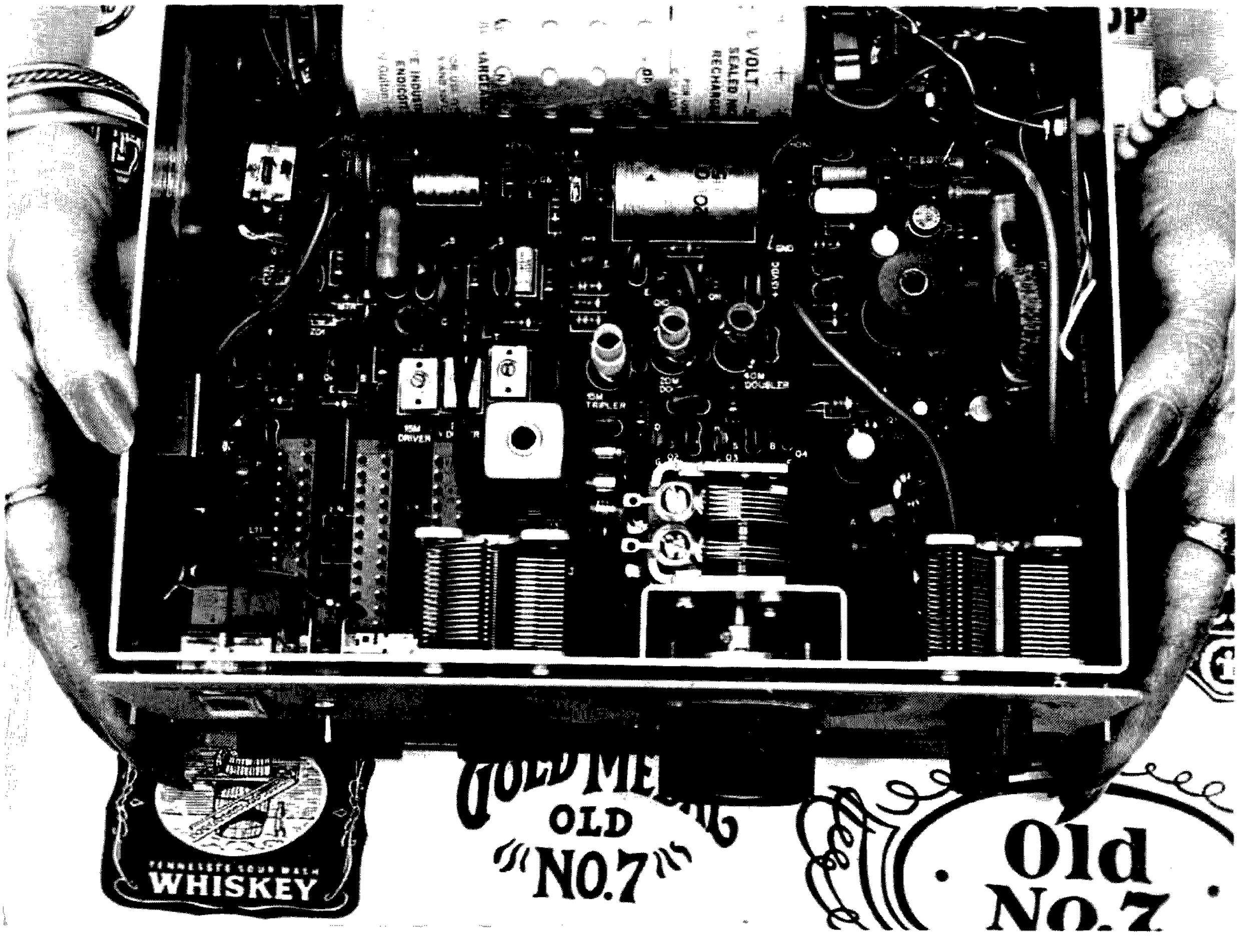
the picture is 66 ms wide. The approximate 6 ms is the retrace, or flyback, period of horizontal sweep, while 66 ms is the "scan" period.

It is my sincere wish that the examples in this article will be of significant value for future Slow Scan understanding and, as a result, we will be closer to an established set of SSTV criteria.

I would especially like to thank Miss Beverly Taylor for the fine photography work in this article. Beverly had a good idea which deserves mention here. She placed a light meter in front of the monitor, got a reading off the initial trace as it scanned, set the camera's F stop accordingly and shot. Every picture came out fine, with good contrast and maximum definition. The room was very dim, the camera was 35mm and the film ASA400.

Finally, the DX shown in this article is typical of Slow Scan activity today. If you're not yet on SSTV, why not join in? It's really a great new mode of communications.

... K4TWJ



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Queen Roger Papa From Hotel Whiskey Seven

One of the many nice things about amateur radio is its eclectic layout.

We're all licensed eclecticians – and some of us are careless punsters. Put in proper English, hamming can be snuck up on from many directions: network with MARS or RACES, heavy DX or just hands-across-the-sea, teletyping, gigacycling with horns and dishes, roundtable socializing, repeaterwork, track-a-satellite, ATV, dreamy designing and build-it-from-scratch. The list is long and getting longer. And it's inclusive – once in the ring you can rassle with everybody.

Few of us settle down for good and all with one mode or one band. Communication is dynamic, a lively art. The opportunities multiply as we exploit them. Tonight, in a little cottage in the west, a thoughtful W6 is putting dust covers on the RTTY gear to invest a few months in looking for YL's on Slow Scan. Soon he'll wonder about color.

A breakthrough in 3D may be the outcome. On a different tack, for more than a year I've been having a lot of fun with low power. The QRP fascination persists, but operating in miniature has lonely moments. It would be nice to have more company at eye-level, and that's why I'm writing this.

Homebrewers may recall that not very long ago it was so easy to end up with a (deleted) mess if you tried to design and build a transistor rig with a genuinely stable vfo, bandswitching and moderately useful power output.

Now, thanks to some of our bright and dedicated colleagues, and to the big-time R&D wizards of commercial electronics, impressive levels of solid-state rf power are within our reach. Stability is no longer a maddening problem, and components are available at prices that encourage building.

All it takes now is patient research, imagination, careful craftsmanship and lots of time. Or, if you just want to get in up to your ankles and have some QRP fun, there's this Heathkit.

The HW-7 is a three-band CW transceiver kit example of how ingenuity, careful engineering and economy can be teamed to turn out a novel and successful product targeted to a small market. Three, two and a half and two Watts on 40, 20 and 15, with sidetone and adjustable break-in. It's compact – four by nine by eight inches, plus fractions – and while the microsizing prizes may go to the two meter hand-helds, along with honors for giant-type repair and modification headaches, you don't need nerveless surgical dexterity to fiddle with the insides of the HW-7.

Every ham knows he can improve on any kit designed by the professional engineers . . .

Remove four screws, lift off the top half of the cabinet and every component is visible. Four more screws to drop the bottom shell and have at the circuit board. No cramping, layering or sequential disassembly tricks. A sturdy and attractive, truly portable, complete HF radio station for eighty dollars.

Today that's roughly the price of two steaks, a candle and a bottle of bubbly at a table the size of a bar stool – in a gloomy ambience of "Continental" fakery. By the time you read this you may have the privilege of choosing between an HW-7 and an evening of beer and pizza.

The simplicity of the front end of the receiver is breathtaking – one tuned circuit and one dual-gate MOSFET. One of the MOSFET gates looks at the vfo and the other at the antenna. You peak the tuned circuit with the "Preselector" control by tuning it to the vfo frequency, and you hear someone as the vfo is tuned to heterodyne with a signal. Audio I.F. With this type of reception selectivity and overall gain are uniquely dependent on the following audio circuitry, although somewhat less so if you want to get fancy with "Q" and amplification in an rf stage.

But simplicity and economy are important factors and the HW-7 is a workable compromise application of a clever concept. Of course there are problems, but in perspective they are acceptable. One is just a nuisance – the idling noise from the high gain audio IC – and another – microphonic sensitivity – is a real pain in the fulcrum.

If you turn up the audio (and only) gain control the footballs of a fly on the cabinet sound like drumbeats. Well, almost. You can indeed talk to the Relative Power Meter and hear yourself clearly in the phones. More about this further down the log.

Every ham knows he can improve on any kit designed by professional engineers, and I suppose a philosophical detachment about this is common in kit factories, but if Heath sees the photo accompanying this article equal time may be demanded, so I'll explain the obvious haywiring.

On the left, fingered by a thumb, a 7,000 kHz crystal market oscillator, then clockwise on the rear panel a toggle switch in the ground return to the added batteries, and underneath it a coax socket paralleling the phono type supplied for the antenna connection.

Next, two six volt nicads and a mess that includes external power terminals, a fuse holder squinched into the hole that held Heath's rather outré (how you like that?) power socket, diode polarity protection (I'm human), ceramic by-passes for insurance and an extra phone jack.

On the right side is a junk box audio filter to take the edge off the IC hiss and microphonics mentioned earlier – an 88 mH toroid in parallel with .15 mF is connected

from ground to the midpoint of two .047 capacitors which are in series between the kit phone jack and the added jack.

If these additions do nothing else they demonstrate that Heath left a lot of room inside the HW-7. You can really fool around in there, and because of the wrap-around cabinet design mounting holes on the side won't show – they think of everything.

Wiring in a speaker amplifier is a temptation I've resisted so far. The manual mentions a nominal 1,000 Ohms output, so for this and other reasons I was surprised to find, after trying several sets, that the headphones I preferred are 8 Ohm (very nominal) and what you might call "bottom of the line" from Radio Shack's stereo salon. Labeled "Nova 10" and priced around four dollars, on strong signals they serve as speakers, not well, but better than you would expect.

Now about the vfo. It's stable enough that I spend too much time listening to sideband on 15, and I suppose someone will soon come up with a scheme to put the HW-7 on DSBSC. The dial is described as "virtually backlash-free" and that's close.

Good verniers are expensive. Although the catalog and manual show dial markings every 25 kHz, mine are every five. Incidentally, a later kit than mine showed another difference – heat sinks are included for the two output transistors. This is a wise precaution I've neglected to copy, although I will, and so far no dissipation problems.

After assembly, dial calibration is a simple synchrodyne two-step, about a minute per band. Checking the results around the dial with test gear did indicate gentle plate bending was in order, and this took a little patience, but once done the calibration stayed put.

It won't serve as a frequency standard, but the vfo's reliability turned out to be good enough to justify removal of that security-blanket low-edge marker oscillator on the port bulk head.

The adjustable timing on the break-in circuit works perfectly, but the sidetone had a rough edge and was uncomfortably loud. Tastes differ, but those readers who have an HW-7 and are unhappy with the sidetone can try the following: Connect a .01 ceramic from base to collector of Q10; add a 47k resistor between C45 and R34; change R35 from 1,000 to 270 Ohms. This gave me a better note, smoother and suitably attenuated, which no one else may hear as an improvement. However, as noted, adding and subtracting from the circuit board is carefree fun.

When you have tuned in a signal with the vfo, peaking the preselector precisely can be a trial. With a tiny knob you are trying to come as close as you can to the best picofarad out of 393.

A vernier here would be nice, even a large knob would help, but out of respect for the aesthete who did a nice job on the panel I just try harder, combining delicacy and expletives. By the way, this control will also, when conditions are right, bring in shortwave broadcast stations – irresponsible elements of the synchrodyne front end, operating in diodyne mode as you tune segments between the ham bands. Fortunately it doesn't do this very well, but on the other hand you may think of it as a bonus.

Relative power output is indicated by the meter, which is driven by a diode connected to a safe point on an antenna to ground voltage divider. Hardly any levity is intended – a dummy antenna provided does indeed warm up when you test the transmitter. The psychological dividend is obvious.

A reminder now that should be unnecessary – Novices are a friendly bunch who couldn't care less about your final power.

A multimeter here would be a nice frill, but, again, UP is where the price would go. However, it's easy to modify the meter circuitry to indicate normal battery voltage and, by the difference between key-up and key-down readings, when charging or replacement is due.

I connected the hot side of the meter to the arm of a miniature SPDT toggler mounted just to the right of the meter – where it neatly replaces a panel bolt. One side of the switch then goes to the normal connection and the other through a 100k resistor to the battery buss.

When the switch is in battery position the meter reads slightly above midscale for

twelve volts. The simplest of mini-changes, but it's very nice to know the condition of your power source when you are operating tiny Watts.

In the beginning operating QRP instead of three or four hundred Watts was educational. It still is. The first revelation was that 40 kHz up from the bottom, a putative rallying point for minipower freaks, seemed to be a frequency with magnetic appeal for CW operators of whatever potency.

I've yet to identify a QRP station at this point on 40, 20 or 15. My fault, perhaps, for exposure atop a 2 Watt molehill tends to be diffident rather than determined.

On the other hand, as QRP experience accumulated it was cheering to find that courtesy was the rule and that, once tiny-mite status was confessed, the fellow on the other end would readily move me to a better spot, fine-tune, filter and listen harder. Courtesy is so common that the occasional put-down is only amusing.

Another lesson was that the relative quiet of the Extra-class CW slots isn't really all that promising for QRP. There's a lot of heavy artillery there, patiently awaiting DX targets of opportunity. One exotic yoo-hoo from Ruritania and you're wiped out.

A reminder now that should be unnecessary – Novices are a friendly bunch who couldn't care less about your final power. Most of them are trying to get their code speed up for the next exam, and working other novices isn't the most efficient way to do it. Working them with error-free CW just fast enough to stretch their mental muscles is of mutual benefit.

In the past I called on them fairly frequently, but not as often as a good neighbor should. The Novice bands are good places to give and get encouragement.

It's a fact of life in QRP country that you have to play your cards carefully. Just imagine throwing away 20 decibels or so of your current electronic pizzazz and then think of ways to compensate. Propagation conditions, antenna efficiency and applied psychology are suddenly very important. So is dumb luck.

The following surprises convinced me that sometimes perversity is well rewarded. Experimenting with supply voltages lower than the 13 recommended in the HW-7 manual (nine turned out to be the low limit) resulted in a childish itch to make it on 20 with six "C" cells. I was still using a 14AVQ, a good vertical but hardly the best for QRP.

One string of CQ's on 14055 and JA7AME replied. We exchanged 559 reports and chatted for about 20 minutes despite a slow QSB and some competition on the frequency, mentioned by Kan but inaudible to me. Due credit to his three element beam. Nevertheless I found it astonishing that a more or less omnidirectional trap vertical, 10 feet above the ground, would lob across the Pacific a significant fraction of my Watt or so of input power.

Kung Fu: "It is easy to push needle into wooden wall. Try it with football and you go bananas."

Considering the efficiency figure of the final, whatever that is, the anomalous losses between it and the antenna, and the wasteful distribution in azimuth, the performance surpasseth human understanding. Mine, anyway.

Satisfactory reports come in from 6's and 7's in the opposite direction, so it doesn't seem likely that the vertical installation has a freak lobe favoring the Far East. Could it be that QRP really works?

Another surprise with the same antenna was SP9PT/VE8, a peak-climbing expedition packing a transceiver and gas-engine powerplant around in the Far North. En route to Mt. McKinley, they came back to a call with 579 from somewhere near Whitehorse.

Good reports are the rule from Alaska, with KL7MF's carrying extra emphasis since Hal – now retired, I believe – was the F.C.C. at Anchorage. For some reason I seem to work a lot of R.I.'s – is there a W.A.R.I. certificate? (How NOT to QSO an R.I. was described in the March, 1966 issue of this magazine.)

The day after the SP9/VE8 contact any remaining skeptical reactance was neatly tuned out by an exchange of identical reports with an 800 Watt powerhouse a hundred miles away on 40. He read his report from a meter and mine was just a guess, and perhaps his receiver had a hot

front end and a low noise figure, but on 7 MHz the HW-7 is no slouch. So smile thank you and enter it in the log.

But there are hard lines too. In the beginning you find out how patient you can be. Call CQ and wait. Again, and wait. Gently rock the dial just to be sure and try again.

Oops, sounds like a station you couldn't hear has just finished a transmission – his contact is replying on the frequency but he doesn't mention any QRM. Bittersweet exculpation. Move and try again in vain.

In your mind an imp sketches cartoons: a fine mist of rf sprays out from your vertical about as far as it would go from the lawn sprinkler; a pingpong ball materializes from the Yagi, arcs gracefully and plops to the ground; electrons sliding back and forth on the long wire occasionally lose their grip and float to the grass. Images of a ruder nature bring a rueful smile. Just don't get discouraged.

If you aren't lucky with CQ's listen for some from a district at an optimal distance according to the time and band, and jump in feet first if you hear no replies. If there's competition don't move away until you hear a contact made.

Playing it cool by opening with a careful search for CQ's that are reasonably strong and unanswered may be the smart way to begin your QRP log, but it's human nature to want to call to an empty corner of space and hear an acknowledging reply.

There are times when reality is a slippery concept and it's nice to be noticed. But however you shuffle the deck, the high cards in this game are patience, determination (stubbornness?) and lore of the art.

Getting results with expertise instead of KVA muscle purchased from a power company is, besides being good ecology manners, a challenging exercise bringing many rewards. Not the least being log entries sure to elicit gasps of admiration from your skeptical Watt-rich buddies.

Snorts of disbelief are equally satisfying, and to these you can reply with a reminder that the narrow edge of the hand has been proven more effective than the blunt fist by hundreds of TV scripts. (If not by the commercials.)

Kung Fu: "It is easy to push needle into wooden wall. Try it with a football and you go bananas."

Another benefit is that competing from a position of disadvantage does discipline the mind wonderfully. Little is taken at face value: ground systems are refurbished; old connections resoldered; everything that can be tightened profitably is; antennas are re-evaluated, lowered, raised, slewed and tipped; mismatches are analyzed and corrected; slipshod and make-do are sins of the past; test gear is put to work as dust motes rise from exhumed textbooks. All that neglected ham housework gets attention and in the process your smarts multiply and amateur radio benefits.

So operating low power on the dc bands is rewarding and instructive, besides being a lot of fun. But it hasn't been a wildly popular aspect of our hobby and I think the Heath Company deserves credit for taking a chance with the HW-7. How about a minute of meditative silence in congenial tribute? I could use that.

. . . W7IDF

MORE SOCIAL EVENTS

from page 21

person; chicken dinner $6 per person. Activities begin at 10 am to sunset, dinner served 1 pm to 3 pm. Program: hidden transmitter hunt, horseshoe pitching contest, ARRL forum, radio control model airplane flying demonstration and fun and games for the kids. For tickets and program send your remittance (check or money order) to 19 - 79 Repeater Association, Box 221, Malden MA 02148.

BEREA OH
SEPT 27

The Annual Cleveland Hamfest and Flea Market will be held Saturday, September 27th, at the Cuyahoga County Fairgrounds in Berea. Easy access from Hopkins Airport, Interstate I-71, I-90, and the Ohio Turnpike. Listen for the Buckeye Belles or Chix and "Talk In" from the East on 146.76, South on .82, West on .88, and locally on .52 and .94. Eastcars, Midcars on 40 and 80 M and 52.525 for farther out. Tickets $1.50 before Sept. 25th – $2.00 at 8:00 when gates open. Flea market parking earlier — bring your own tables. For early tickets and information on motels and campgrounds, send a check and SASE to: Cleveland Hamfest Association, Box 43413, Cleveland, Ohio 44143.

MADISON WI
SEPT 28

3rd Annual Dane Co. Swapfest will be held in Madison WI, Sunday, Sept. 28, 1975 at the Dane Co. Expo Center Youth Bldg, rain or shine. Sponsored by Madison Area Repeater Association. Prizes, all you can eat pancake breakfast and beef bar-b-q luncheon, family fun, commercial exhibits. Adv tickets & tables $1.50 – $2 at door. For advanced tickets write M.A.R.A., Box 3403, Madison WI 53704.

LOUISVILLE KY
SEPT 28

The Fifth Annual Greater Louisville Hamfest will be held on Sunday, September 28, 1975 at the Kentucky National Guard Armory on Crittenden Drive at I-65. There will be a large indoor exhibitors area, large paved flea market area, club meetings, technical forums, prizes for the whole family and ladies' Bingo. Admission adults $1.50 – under 12 free. Flea market pays admission plus $1 per space. For info contact K4GOU, 2415 Concord Drive, Louisville KY 40217 (502 634-0619).

ADRIAN MI
SEPT 28

The Adrian Amateur Radio Club, Inc., will hold its Fall Hamfest on Sunday, September 28 from 8 am to 3 pm at the Lenawee County Fairgrounds, Dean Street in Adrian. All buyers, sellers and visitors welcome. Cost $1 in advance. $1.50 at gate. Table size 8 ft. $1.50 per half. Talk-in on 146.46 – .52 – .94 MHz. For more information write Adrian Amateur Radio Club, P.O. Box 26, Adrian MI 49221.

OTTAWA ONTARIO
OCT 3-5

The 1975 Radio Society of Ontario Convention, hosted by the Ottawa Amateur Radio Club, will be held at the Skyline Hotel, Ottawa on October 3, 4 and 5, 1975. Programs include: 9 technical forums (including W2NSD/1, 73 Magazine's Wayne Green), commercial exhibits, flea market, technical displays, C.R.C. satellite display, major drawings and door prizes, and much more. The Skyline Hotel is located within walking distance of Parliament Hill, National Arts Centre, the Royal Canadian Mint and in a major shopping area.

EAST RUTHERFORD NJ
OCT 4

The Knight Raiders VHF Club's auction and flea market will be held on Saturday, October 4th, at St. Joseph's Church of East Rutherford, Hackensack Street, East Rutherford. Free admission, free parking, refreshments available. Talk-in will be on 146.52 and 146.94. Flea market tables: $5 for full table, $3 for half table. Reserve your tables in advance by writing to The Knight Raiders VHF Club, Inc., K2DEL, P.O. Box 1054, Passaic, New Jersey 07055.

WAKEFIELD MA
OCT 4

Quannapowitt Radio Association annual auction, greatest and oldest in N.E., Saturday, October 4th, St. Joseph's Parish Hall, Wakefield, Massachusetts, 10 am to 4 pm, doors open 9 am, 10% commission, no minimum. Door prizes, special prizes. Talk-in 146.52.

MEMPHIS TN
OCT 4-5

Memphis is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, October 4 and 5. Demonstrations, displays, MARS meetings, flea market, prizes. Talk-in on 3980, .34-.94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis TN 38127 or telephone 901 358-5707.

LEAGUE CITY TX
OCT 5

The Tidelands Amateur Radio Society's annual hamfest is Sunday, October 5, 1975, 9 a.m. 'til-? at the Galveston County Park, League City. Advance registration $1.50; $2 at door. Free parking, refreshments available. Main drawing for door prizes will be at 3:00 p.m. Swap booths available. For information, send a S.A.S.E. to Luke Sterling, 105 Seabreeze Drive, League City, Texas 77573.

WARRINGTON PA
OCT 5

The Mt. Airy VHF Radio Club (the Packrats) are holding "Hamarama 75" at the Bucks County Drive-In Theater, Route 611 (Easton Rd), Warrington, Pa., on Sunday, 5 October 1975, 8 am to 4 pm. Registration $1.00, tailgating $2 – bring your own table. Parking for 1000 cars. Talk-in via W3CCX/3 on 52.525, 146.52 and 222.98/224.58 MHz. For information contact Lee Cohen K3MXM, 8242 Brookside Rd, Elkins Park, Pa. 19117. Phone (215) ME5-4942.

COLUMBUS OH
OCT 10-11

On October 10 and 11, 1975, the ARRL Great Lakes Division Convention will be held in Columbus, Ohio. The actual site is on the north side of the Ohio State Fairgrounds just off 17th Avenue. There will be a number of well-known personalities among the amateur radio fraternity there both as guests and as speakers. For more information contact: Ira Bickham, Chairman, Industrial Displays, 1423 Thurell Road, Columbus, Ohio 43229.

Jerrold Swank W8HXR
657 Willabar Drive
Washington OH 43160

40m DX Antennas - The Easy Way

The trouble with 40 meter antennas is that they are usually longer than city lots, unless they are verticals. Then they are dependent on hard to dig radials. That is my problem. But what if antennas were half as long, and didn't need radials?

I have a 74 ft. wide lot, and was using 40 meter phased verticals to handle phone patches for the Antarctic stations during their winter, when no mail goes in or out. My yard is full of trees, most of which are as high as the verticals, and they are in leaf during this period, when it is summer here.

After several seasons, during which I handled a lot of traffic, I decided I needed to get a better signal from down there, and as well, put in a better signal to them.

I read an article on folded half wave radiators (by William Orr, *Ham Radio,* March, 1970) and tried one out. However, a horizontal antenna must be nearly a half wave above ground, or its DX properties are no better than my verticals with no radials. Then it dawned on me that vertical dipoles need no radials, and sloping dipoles have gain off the front of the slope.

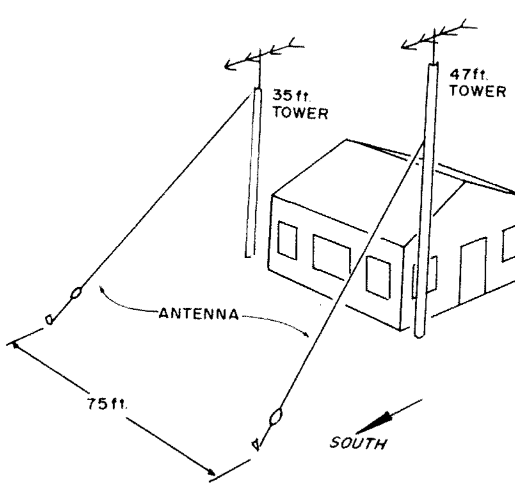


Fig. 1. Antenna layout.

My towers are only 48 ft. apart – not a half wave, but I decided to try. I sloped one dipole from the top of my 35 ft. TV tower to the southwest corner fence post at the back of my yard, and the other from 35 ft. up on the 47 ft. ham tower to the southeast corner of the yard. The antennas were pulled up by pulleys, making them easy to adjust and tune. On the southeast antenna I was 10 dB stronger in Miami (167°) than in New Orleans (211°), and vice versa when I used the southwest antenna. When I used both of them I was better in both directions than with either one alone.

When I started to handle traffic to the Antarctic I was amazed. I pinned the meter on several occasions at South Pole Station, and was 10 over 9 at McMurdo Sound. That season I ran more patches during June, July, August and September than any other station and was told by McMurdo that I ran more than one fourth of all patches in spite of the fact that I used only 40 meters and they used both 40 and 20 and 20 meter MARS. Many nights I was running phone patches when the other two "regulars" were unable to even copy the Ice stations. Fig. 1 shows the layout of the antennas. It is

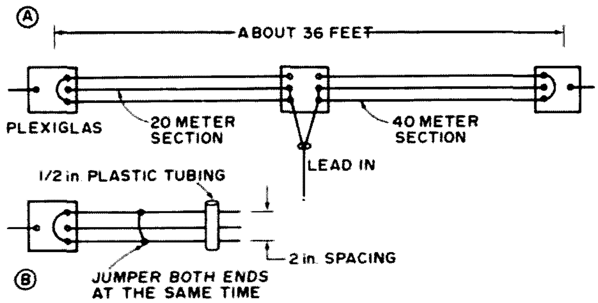


Fig. 2. (a) The design of the antenna. Cut the antennas for the low frequency of the band, and then, if necessary, tune by adding the jumper as shown. Then tune the higher frequency antenna by trimming at the ends. The antennas will cover quite a good band with low swr. (b) The 40m section can be tuned by moving the jumper.

important that both antennas be tuned to the same frequency for accurate phasing. By inserting a half wave of coax in one leg I can end fire into California and the East Coast, although the gain from the slope will be missing in these directions.

Fig. 2 shows the design of the antenna. The length of the dipole will be about the same as any other type of dipole and should be cut for the low end of the band. The 40 meter section can be tuned by moving the jumper as shown in Fig. 2b. Move both jumpers – one at each end – the same amount toward the center to shorten the antenna. To shorten the 20 meter section just trim both ends. There will be little

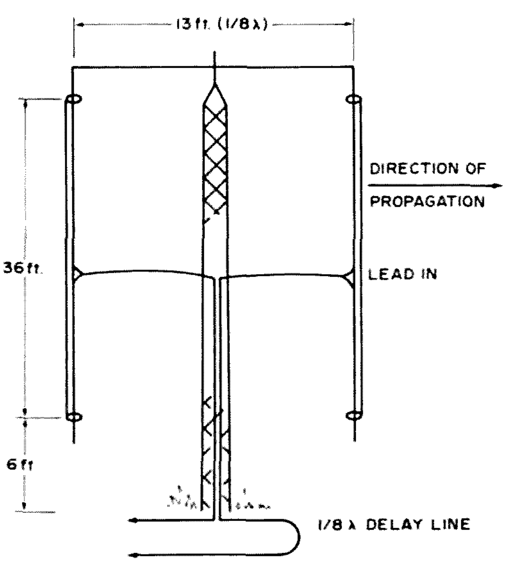


Fig. 3. Alternate antenna array for one tower. This array is 1/8 wave spacing on 40 meters and ¼ wave spacing on 20 meters – a very good combination. A little imagination would show you that this could be made to rotate.

reaction between the antennas. The spreaders can be made of 3" lengths of 1/2" plastic tubing, with holes spacing the outside wires about 2" apart, and the other antenna between them. Space the spreaders about 6 ft. apart and fasten them either with epoxy cement or by making the holes slightly small so they won't slide. The wire can be #16 or #14, prestretched.

The tops of the antennas are about 33 ft. high, and the bottoms are about 6 ft. off the ground out of the reach of children.

Do not use a balun, and connect the coax shield to the lowest side of the dipole. It is easier to understand this antenna if you think of it as a ground plane with one radial.

A prominent antenna manufacturer told me that this array with the slope probably had a gain of about 10 dB.

I used RG59 for the lead in. The current is divided between two antennas, and RG59 has ample capacity for full legal power this way. I used 3/4 wavelength in each lead in. This makes a transformer match and gives me close to unity swr. Run the lead in at right angles from the antenna as far as possible. Keep the vertical angle less than 45° if possible to get maximum vertical polarization. You will be pleased with the absence of noise because of the nulls on the side of the array, and the lack of interference.

If you do not have two towers, try Fig. 3 for a one tower array. This is a cardioid array, with no slope, but takes advantage of the shortened antenna and phasing. By changing the delay section to the other lead in the direction of the array will be reversed.

There is one more array which this combination makes possible. This is shown in Fig. 4. Going back to my comments about the directive effect on my two antennas in different directions, a new idea comes up.

How about a rotating beam made of three or four antennas sloping from the top of a 35 ft. TV tower? You can either use separate feedlines or a Dow Key relay. If you use the relay, which grounds the unused lines, make the lead from the antenna to the relay 1/4 wave. This will open the center of the unused antennas and detune them. If you have a switch which leaves the lines ungrounded, then use half wave lines and they

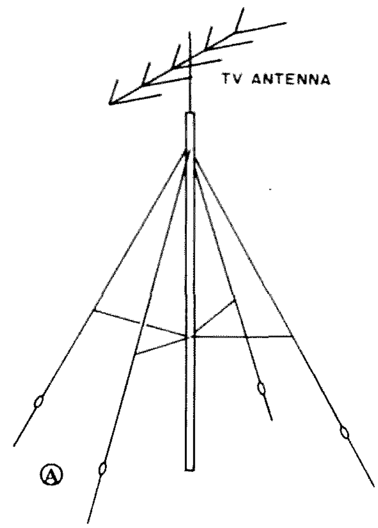
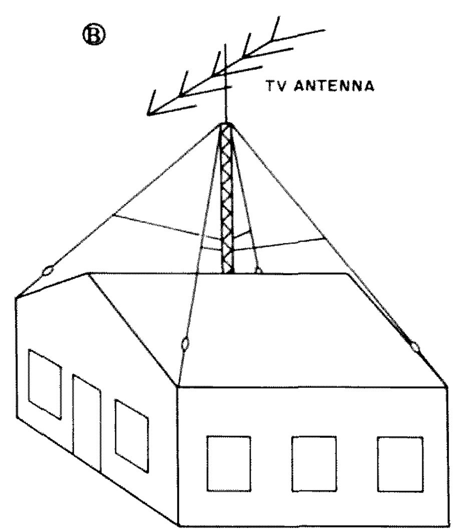


Fig. 4. (a) Rotating wire beam. You can either use four feedlines or use a relay. If you use a Dow Key relay, which grounds the unused lines, make the lead from the antenna one quarter wavelength to the relay. Then, when grounded, the antenna will be open in the center and detuned. If you use a coaxial switch, use half wavelengths from the antenna to the switch, and when the lead in is dropped from the switch the center of the antenna will be opened and thus detuned, by the rule that a half wave repeats the open impedance at the other end of the line. If you use a Dow Key relay with three positions, you can use just 3 antennas with nearly the same results. Naturally, you can also use the three antennas as guys for the tower. (b) Antenna mounted atop the TV tower.



will also detune the unused antennas. Naturally, you can also use the antennas to guy the tower.

Last but not least, how about a tower on top of the house with antennas to each corner of the house, for a NO SPACE antenna array?

. . .W8HXR

Alan L. Bridges WB4VXP
2754 Pine Hill Dr. NW
Kennesaw GA 30144

The Oscar Zapper

Conclusion

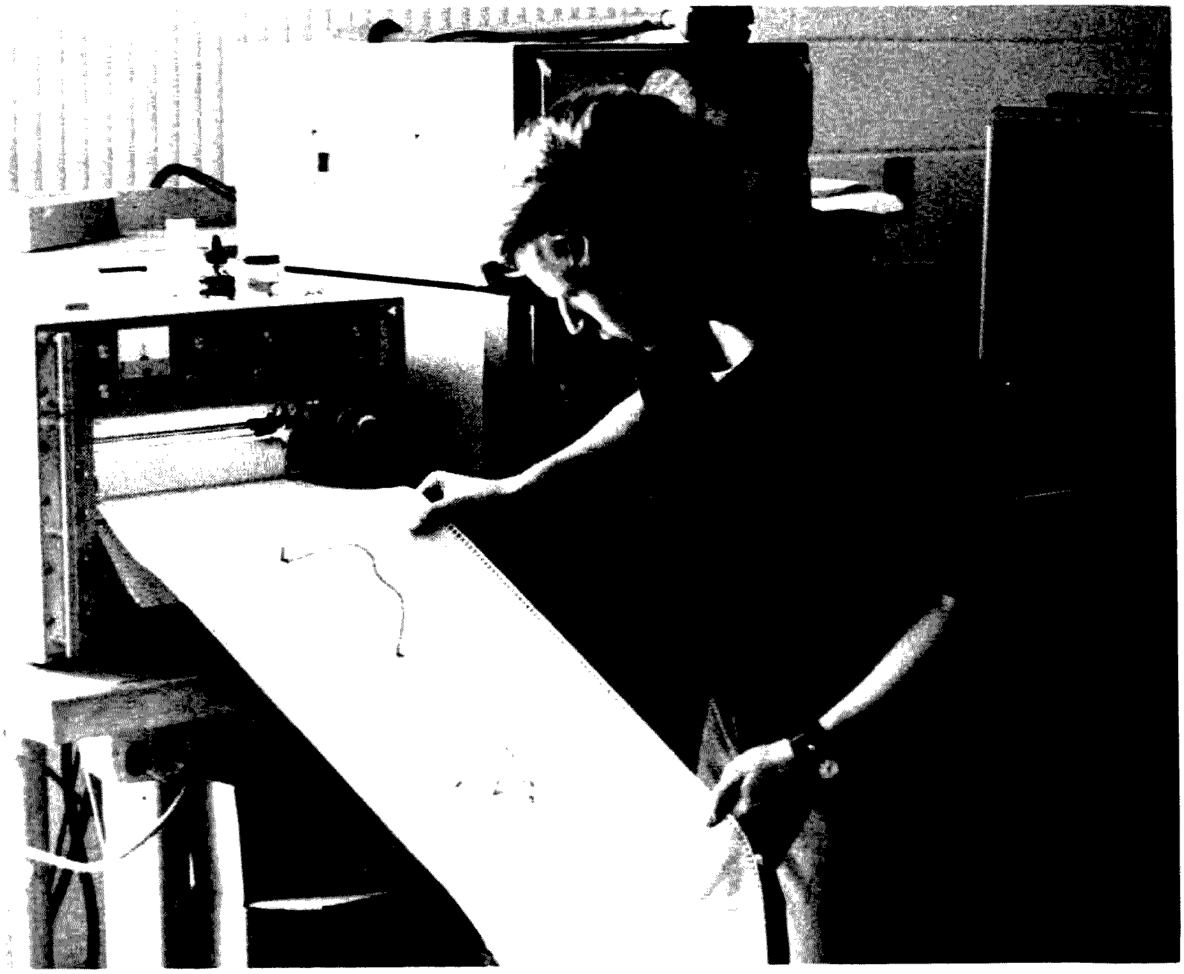
In beginning this project I felt that the helices would work very well and would yield a 12 to 15 dBi circular gain. I also thought that it was necessary to measure the gain as well as the antenna radiation pattern, so that the performance of the helices could be verified. Since I was a graduate student in physics at Georgia Tech, the antenna pattern was measured using the facilities that are available at the Georgia Tech Engineering Experiment Station and the Antenna Lab of the School of Electrical Engineering. I hoped to be able to perform the antenna measurements and actually see if the pattern (i.e. the beamwidth) and the gain of the antenna were comparable to the theoretical pattern and gain. Cliff Burdette WA8GRE, Research Scientist at the Georgia Tech Engineering Experiment Station, and I made the pattern measurements in April and May of 1974 (before the array was completed).

The 70 centimeter helix was measured on the outdoor antenna range located on the roof of the Electrical Engineering Building at Georgia Tech. Instrumentation consisted of a Scientific-Atlanta amplitude receiver, a series 1520 pattern recorder, a UHF oscillator, and an antenna positioner control and turntable. A block diagram of the measurements setup is shown in Fig. 5. Using this configuration, patterns of the principal planes of the antenna were measured for both linearly and circularly polarized transmitting antennas. The antenna range is, however, not free from reflections. Nearby objects such as building corners and a crane prevented us from obtaining "free space" conditions. However, the far-field pattern can be measured since the far-field distance for the two antennas was only ten feet, as given by:

$$\text{Far-field Distance} = \frac{2(D_1 + D_2)^2}{\lambda}$$

where D_1 and D_2 are the largest aperture dimensions of the transmitting and test antennas, respectively. At this distance, the reflections should be approximately 40 dB below the maximum signal of the test antenna.

The measurement of an antenna pattern (i.e. the far-field pattern) involves the test antenna, whose pattern is being measured, and another antenna located at a certain



Cliff Burdette WA8GRE observes one of the antenna patterns as it is generated by the recorder. Equipment used in the pattern measurements is located in the background.

distance away, that is, in the far-field region. The test helix is used as a receiving antenna and at the same time rotated about a vertical axis through the desired angles in measuring the pattern. The test antenna was operated in the axial mode with right circular polarization. Two different transmitting antennas were employed – a half-wave dipole and a 3 turn helix of the same polarization of the test antenna. Pattern cuts were taken using both transmitting antennas. The measured beamwidth of the test helix is approximately 39 degrees (and corresponds to the theoretical value). This represents an adequately directive antenna for amateur satellite communications. The pattern nulls are quite good and nearly symmetric. The patterns, shown in Figs. 7 and 8, do show a slight asymmetry or distortion. This might be due to the location of the feedpoint of the test antenna. The helix was fed approximately 2 inches to the left of the axial center. This effectively produces a "tilt" in the pattern of the antenna. The level of the first lobe is approximately 16 dB below the level of the main beam of the antenna. However, this tilt is more likely to be a result of the antenna range itself as the reflections from the building and the crane and other factors can very easily cause such a tilt. The level of the first lobe cannot be pinned down because the pattern is slightly nonsymmetric. One lobe is 9 dB down, while the other is 16 dB down, as shown on the 40 dB plot of the pattern (Fig. 7). A minimum level of about 10 dB below the level of the main beam is desirable.

The gain measurements were made by direct comparison with a dipole, and the resulting gain was approximately 16 dB over a half-wave dipole. Since the gain measurements were made at 445 MHz, the gain at 432 MHz (the design frequency) would be less; nevertheless, the pattern results that

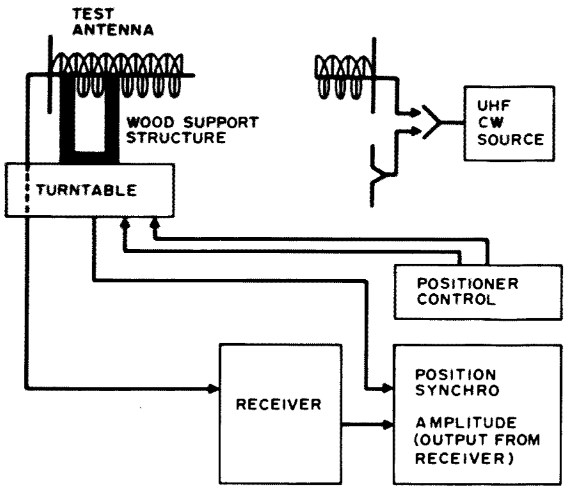


Fig. 5. Block diagram of antenna pattern measurements setup.

were obtained indicate that these antennas should be performing very well.

My results almost exactly correlate with Dr. Kraus's original graphs, i.e., the measured beamwidth and the theoretical beamwidth are practically the same. Since the center or design frequency is 432 MHz and since the gain depends on the circumference C, the number of turns n, and the spacing S, it can be easily seen that, as one goes to a higher frequency or frequencies above the design frequency, the gain will correspondingly increase [from Gain = 11.8 + 10 $\mathrm{Log}_{10}(C^2 nS)$]. Likewise, at frequencies below the center frequency the gain will decrease. Here the measured gain at 445 MHz corresponds to the correct increase, so at 432 MHz the gain should be about 14.7 dBi circular.

Another very important measurement is the axial ratio or ellipticity, especially where circularly polarized antennas such as helices are concerned. Here the axial ratio is the ratio of the major axis to the minor axis of the polarization ellipse. For the axial mode helix the axial ratio is described approximately by AR = 2n + 1/2n, where n is the number of turns. For n greater than 3, the axial ratio will be nearly unity.

I tried two different ways of determining the polarization. The pattern method utilizes a linearly polarized directional antenna and also a circularly or elliptically polarized test antenna. A polarization pattern is traced out in this method. Basically, a circle is generated for circular polarization.

The other method is the circular component method. In this case, it is necessary to use two circularly polarized antennas of opposite sense. One must compare the relative signals of the two helices, E_{lcp} and E_{rcp}, to find the axial ratio:

$$AR = \frac{E_{rcp} + E_{lcp}}{E_{rcp} - E_{lcp}}$$

If the axial ratio is positive, then the wave is right circularly polarized. For these helices, AR will be very nearly unity. In my radiation pattern measurements I used two three turn helices of opposite sense plus the eight turn test helix for 432 MHz. Suffice it to say that the 8 turn helix was right circularly polarized (AR approximately 1.07, as compared to 1.0555 theoretical).

Conclusion

A lot can be said about helices and their good characteristics, and how they can be successfully used on the amateur bands. I

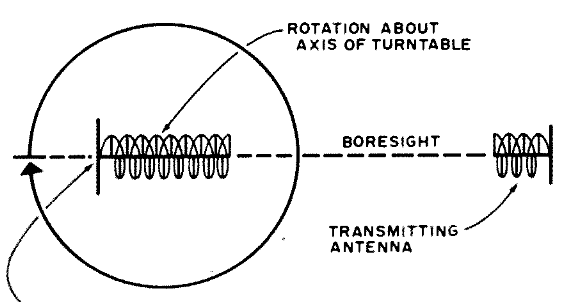


Fig. 6(a). Pattern measurement using test antenna for reception.

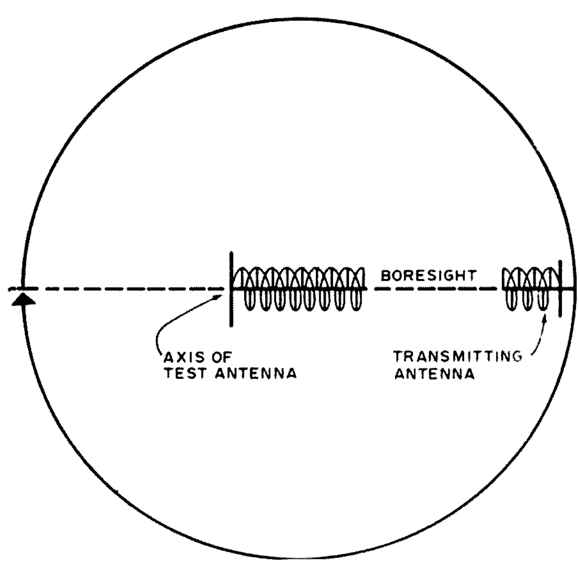
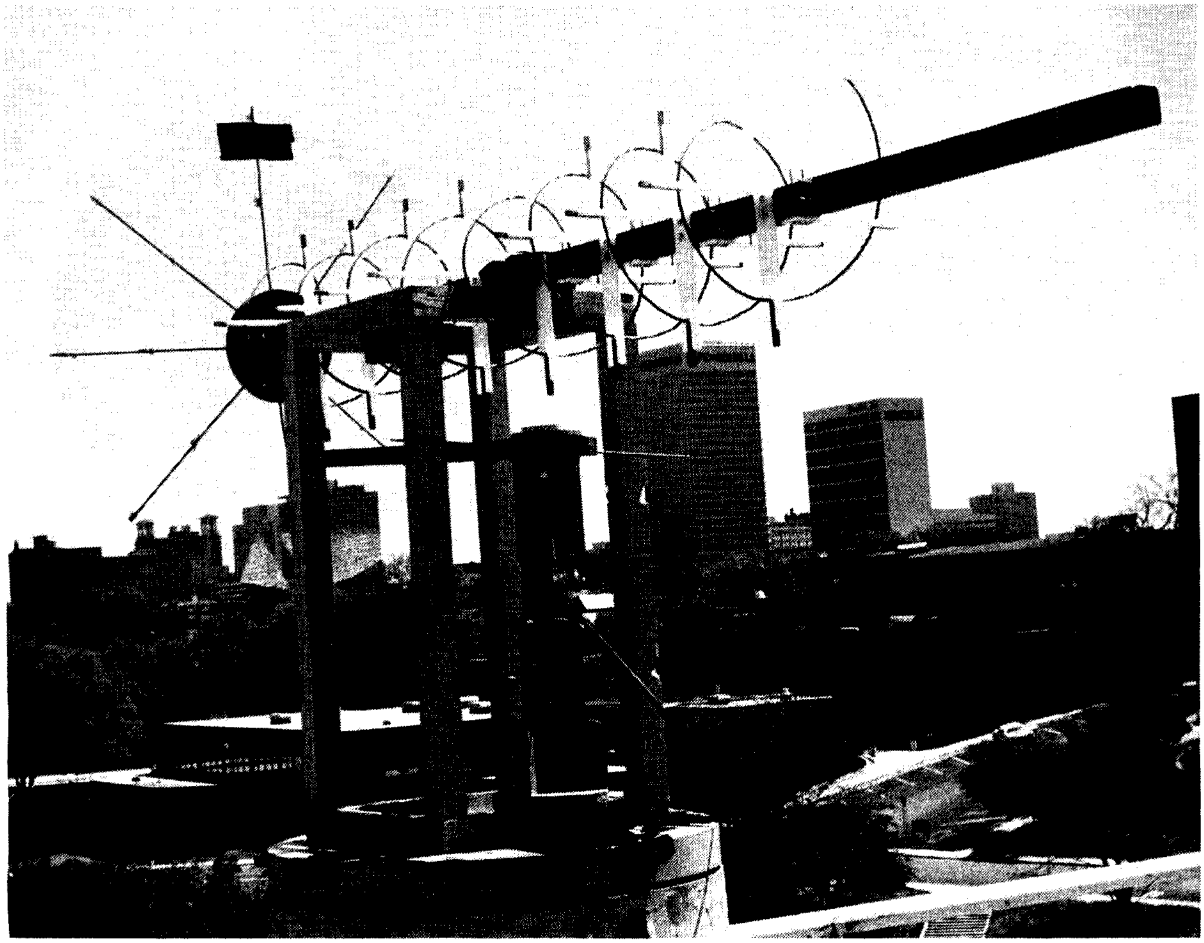


Fig. 6(b). Pattern measurement using test antenna for transmission.



The test antenna used during antenna pattern and gain measurements was the 8 turn 70 cm helix shown here. The helix was mounted on a wooden structure and placed on top of the turntable. The half-wave dipole used during gain measurements is located toward the front of the helix in the center of the picture.

feel that these antennas deserve more attention than they have gotten, even though I do not expect everyone to rush out and build an array like the one that I have. The project, as I call it, has involved a lot of my time, but I do feel that every minute was worth it. I have learned a lot about these antennas and have really gained experience in such areas as the construction techniques and mechanics of rotating systems. At this time I am installing or reinstalling the array with the updated azimuth-elevation rotor and the remounted helices.

The earlier version of the helical array was completed in August, 1974, but due to problems with balancing of the array and the elevation system during the winter, I had redesigned this part of it – hopefully, for the better.

I have found that, by making use of surplus materials in putting the array back together, I could come up with both a small investment and a mechanically sound antenna array. Also, in remounting the helices I decided that a counterbalance system should be installed, since I had found it very hard to balance the first array. Improper balance alone would cause rotor problems. By eliminating, in this updated version, the major stresses encountered with the elevation drive, the mechanical problems are solved, which means I can use the antennas more without having to keep working on the array.

Other "gleanings" have come out of the project, basically from building and working with the helices. I somehow found the time to build a 10 turn helix for 2 meters, which I entered in a home brew antenna measuring contest at a hamfest last October. Needless to say, this array was quite large, but its performance was what I expected and brought a first place in the "most gain" category of the contest. From this helix,

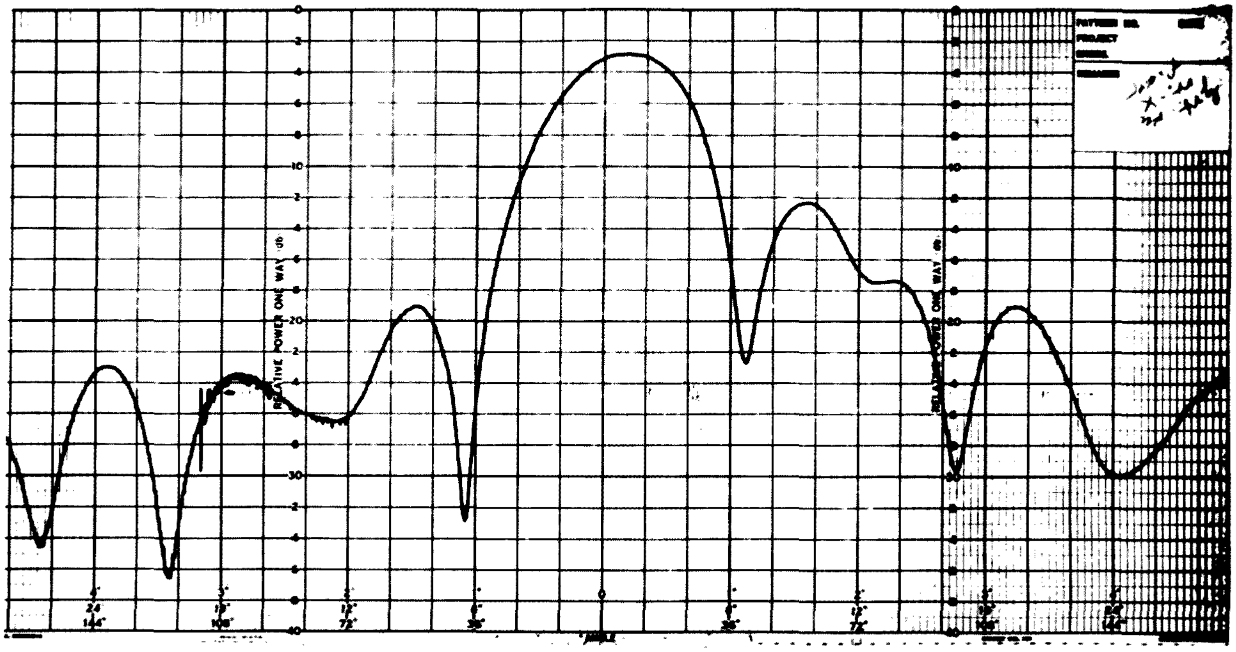


Fig. 7. Radiation pattern for 8 turn helix taken on a 40 dB rectangular recorder.

which was basically designed to be built and taken apart in less than an hour, I have found that a ground plane made of an aluminum plate with 8 radials will suffice. Here my original installation was too heavy and the ground plane for the 2 meter helix was the major factor. So in redoing the array I have tried to reduce the weight where possible without sacrificing any of the performance of the antenna.

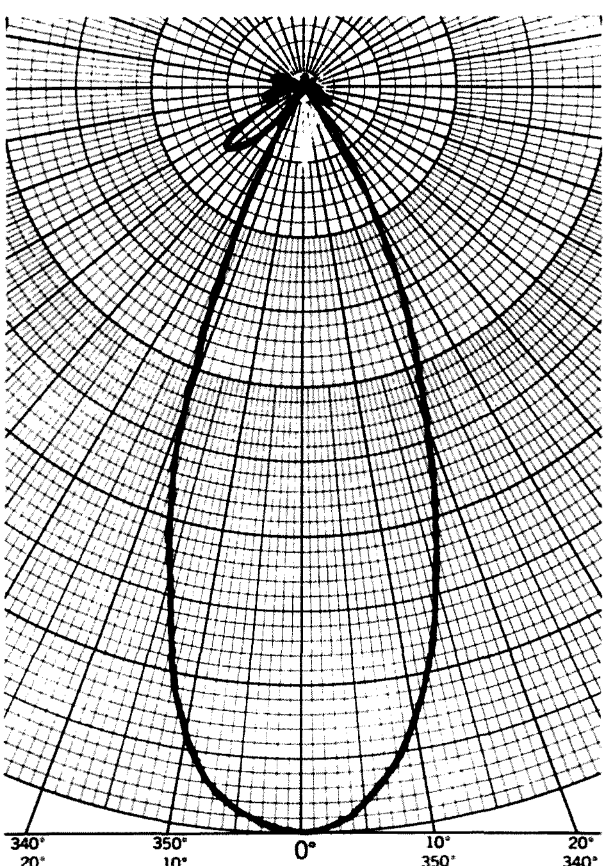


Fig. 8. Polar plot of radiation pattern of 8 turn helix.

Another factor in putting together these antennas was utilizing materials available at the lowest possible cost. The plexiglass supports, which can be used up to 1000 MHz, were spaced at 90 degree intervals along the turns of the helix, even though other spacing could have been used. Also, 120 degree spacing on a triangular crossed sectioned boom could be used, depending upon the band of operation and the type of wire used for the conductor of the helix.

Fiberglass or aluminum can be used for the boom. Aluminum does not degrade the wide band characteristics of the helix when it is used primarily as a narrow band antenna, although the helix conductor must be insulated from the aluminum boom.

Since the helix is pretty broadbanded, i.e., a design at 160 MHz will operate well at 137 MHz and 220 MHz, so construction techniques depend on its basic use or application (Ref. 1, 2 – see *73* #178, page 64). For instance, a high performance array of helices could be built for working moonbounce, possibly using 4 helices of about 20 turns to obtain about 24 dBi circular gain. (Or possibly more than four antennas could be stacked to get more gain, such as is done by W8JK's 96 helix array at Ohio State.)

As far as satellite work is concerned, I believe that the helix will out-perform any other antenna (with the possible exception of a parabolic dish at 432 MHz). The whole point in putting together this array was to be able to use antennas of different polarization with Oscar 7, thereby optimizing the chances for success with the satellite. In the earlier version of the array I did make receiving tests on Mode B of Oscar 7. By using the 6 turn helix on 2 meters, with right circular polarization, and also a 4 element yagi, I have compared signal fading on this mode. Here I used both a 2 meter converter (Microwave Modules) and my Gonset GSB-2 SSB transceiver on 2 meters. I received very strong signals with both antennas, but with the yagi I do get fading every 5 to 7 minutes or so. With the helix and the yagi both tilted at 30 degrees and only rotated in azimuth, I have found that the fading problem inherent in the yagi is not found with the helix. I did not really take any qualitative measurements or data on this, but when I do get this updated version I do plan to make some serious polarization measurements of both modes of Oscar 7 and also of Oscar 6.

With the rotor problems and re-installation of the array, I have not used the antennas as much as I should have. Making use of the tracking capability of the array, I plan to make some more polarization measurements, switching from right circular, left circular, and linear polarizations. Here also, the array will be diverse, as I can use the rcp helix for Mode B, the lcp helix for Mode A on 2 meters, and the lcp helix at 432 MHz for the beacon at 435, 1 MHz. By choosing the number of turns that correspond with just enough gain to work Oscar, and with the appropriate polarizations, this array will truly be capable of performing well in all respects.

Acknowledgments

I wish to thank WA8GRE, Cliff Burdette, Georgia Tech Engineering Experiment Station, who assisted me in making the antenna pattern measurements and collaborated in writing the section of the article concerning that subject. I also wish to thank WB4KUX for his help and suggestions.

. . . WB4VXP

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Digital SWR Computer

Conclusion

Once the swr computer is built, you should check its proper operation before connecting it to an swr directional coupler. At this time some minor adjustments may be necessary.

Whether or not adjustment is needed depends on the quality of the 741 operational amplifier ICs. Ideally, if an op amp receives an input of 0 volts (that is, its two inputs are shorted together), its output should also be 0 volts, In practice, however, this does not happen. Instead, in order to obtain a 0 volts output, a slight input voltage (either positive or negative) has to be applied between the two inputs; this is called the input offset. For good quality op amps, this input offset is very small, on the order of millivolts. However, many of the 741 op amps available to the amateur at low prices are of dubious origin – such as factory rejects. One common reason for being rejected is that a unit may have a high offset voltage requirement. Although such an amplifier may still be perfectly usable for ac amplification, the offset voltage introduces a slight error in dc amplification applications. For this reason, we will check the operation of the 741 op amp ICs in this circuit, and if necessary introduce a slight amount of "offset compensation," which will compensate for the high offset and produce normal operation.

As an initial check, connect the V_F input to a 1.5 volt dry cell as shown in Fig. 7; this puts about .26 volts dc on the V_F input. Turn both R1 and R2 to minimum, and turn on the ac power to the power transformer. At this time the decimal point on the center LED should light, and the display may or may not be on. If the center decimal point is not on, turn off power and check the power supply.

Now slowly turn R1 toward its maximum setting. As you begin, the display should start to flash on-off-on-off . . . , and the flashing speed should get faster and faster as you continue to turn the pot until eventually it looks as though the display is on continuously (it is still flashing on and off,

but so fast that you cannot see it). If this does not happen, refer to the troubleshooting section later in these instructions, and come back here after you find the problem.

Offset Compensation of IC2 and IC3. Now carefully turn R1 back toward its minimum setting. As you approach the minimum, the display should start to flash on-off . . . at a slower and slower rate, as slow as once every second or two, and should just *stop* flashing as you reach the minimum setting of R1. (As it stops flashing, it will either stay permanently on or stay off.) The important factor is that the flashing should stop just as R1 reaches its minimum setting, or else that the flashing should be *very* slow – not more than once a second or two. If this is so, IC2 and IC3 are OK; skip down to Offset Compensation of IC1, below. If not, simply interchanging the three 741 op amps (assuming that you used IC sockets or Molex pins) may produce good results.

On the other hand, if either the flashing stops *before* R1 reaches it minimum setting, or else the display still flashes fast although R1 is already at minimum, then compensate IC2 and IC3 as follows:

Obtain a 100k potentiometer, and temporarily connect it between pin 4 of IC3 (this is the -9 volt line) and *either* pin 1 of IC3 (if the display still flashes when R1 is at the minimum setting and you want to slow it down), *or* pin 5 of IC3 (if the display stops flashing before you get to the minimum setting of R1).

Adjust the 100k pot so that, with R1 at its minimum setting, the display is just on the verge of flashing at a very slow rate. When this is done, remove the 100k pot, carefully measure its resistance, and substitute an equivalent fixed resistor (½ to ¼ Watt) in its place.

Offset Compensation of IC1. After IC2 and IC3 are compensated, if needed, adjust R1 so that the display flashes fast enough to look as though it is permanently on. Now adjust R3 so that the display reads 01.0; as with any digital device, there may be a slight amount of flicker in the least significant digit, so adjust R3 until this flicker is at a minimum.

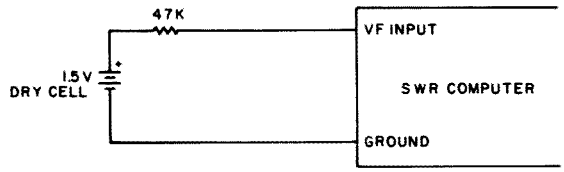

Fig. 7. Input test circuit.

Now turn R1 back toward its minimum setting. The display reading should stay between 00.9 and 01.1, and preferably at 01.0, as the display starts to flash more and more slowly. If it does, IC1 does not need compensation.

If compensation is needed, connect a 100k pot temporarily between pin 4 of IC1 and *either* pin 1 of IC1 (if the reading goes below 1 as R1 is turned lower), *or* pin 5 of IC1 (if the reading goes above 1 as R1 is turned lower).

Adjust the 100k pot so that the reading stays at 01.0 ± 0.1 as R1 is turned through its range. When finished, replace the pot by a fixed resistor of the same value. The offset compensation should be good for the life of your instrument.

Connection To Directional Coupler

A certain amount of discretion is needed in choosing an appropriate directional coupler (swr bridge) to use as the rf sensor. Though a coupler can easily be constructed using any of the variety of circuits given in ARRL publications and the ham magazines, the simplest and fastest solution is to connect into a commercially made swr bridge. The following description takes the latter approach, and describes the connection into a simple "Swr and Field Strength Meter" available from Lafayette Radio as their model 99-25371. To aid you in identifying this model, which is also available from other sources, a simple drawing is shown in Fig. 8. However, almost any swr bridge can be used as the sensing unit.

The internal circuit of the swr bridge is shown in Fig. 8.

In the particular sample of this swr bridge which we examined, forward voltage outputs for typical amateur powers were between about 0.2 and almost 10 volts, well within the range of the digital swr computer. (Incidentally, though this particular unit is

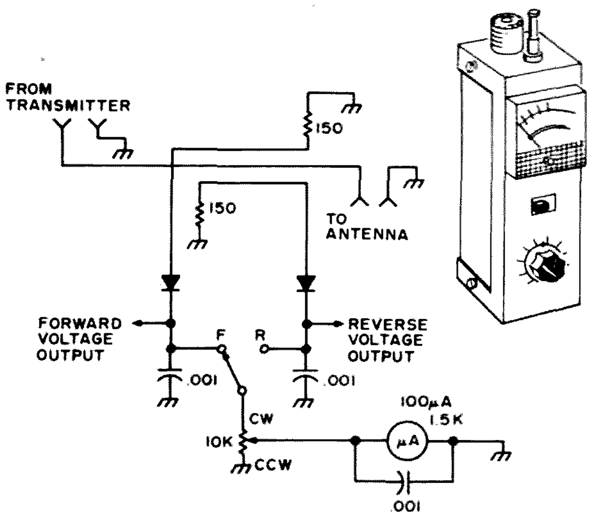

Fig. 8. Typical commercial swr bridge.

rated for use up to 30 MHz, we have in the past found it reasonably accurate even for use at 147 MHz, where a transmitter power of 10 Watts produced a forward voltage of about 4 volts.) In general, the higher the transmitter power or the higher the operating frequency, the higher the output voltage.

The connection to the swr computer consists simply of bringing out the forward and reverse voltage outputs as shown in Fig. 8.

Since the input resistance of the two swr computer inputs is approximately 10k, connection of the computer to the standard bridge does not upset the circuit operation; the swr bridge can still be used in its normal mode. This is of some use in checking the calibration of the computer.

On the other hand, the fact that the swr meter is connected to only one bridge output at a time can cause erroneous readings from the computer. For foolproof operation, the 10k pot in the bridge should ideally be disconnected from the switch. Actually, this is not necessary, as the computer can be calibrated to compensate for the 10k pot's existence, as long as the pot is in the fully counterclockwise position (to take the meter resistance out of the picture) and care is taken to leave the Forward-Reflected switch in the same position at all times.

If a different bridge or directional coupler is used, make sure that the two diodes are oriented as shown so that the bridge output voltage is positive, not negative.

Calibration

The voltage-to-frequency converters are quite linear over a range of more than 40 dB, that is, over a voltage range of 100 to 1, or a power range of 10,000 to 1. Hence adjustment of input levels is not too critical, with the only requirement being that the input level controls be adjusted so that, with the typical range of transmitter powers to be used, the circuitry operates within the linear range of operation.

At the upper limit of the usable range, operation of the circuit is quite linear up to the point where the voltage-to-frequency converter suddenly stops operating. This condition is quite obvious to the user. At the lower end of the range the accuracy drops before the voltage-to-frequency converter fails to function completely; however, a built-in safety device exists in that the display starts to flicker on and off at a noticeable rate when in the doubtful range, as a visual warning.

Calibration is done as follows:

1) *Adjustment of R1.* Connect a voltmeter across the 10k resistor labeled R4 (positive lead to ground). Connect the V_F input of the computer to your bridge, but temporarily leave the V_R input grounded. Now key your transmitter at your normal power and adjust R1 so that the voltmeter indicates about 1 volt. Then disconnect the meter.

Explanation: The voltmeter is measuring the applied voltage going to the voltage-to-frequency converter handling the $V_F + V_R$ signal; the range of fairly linear operation is from about 0.02 to about 2.5 volts. Our object here is to adjust the forward voltage input level to operate the converter in the linear portion of its range. With the normal V_F applying slightly less than one half of the full-range input allowed, we have enough headroom so that even with a very high swr (so that V_R is about the same as V_F, and their sum is twice as large as V_F) we are still in the linear range of operation. If you want to keep the calibration such that the swr computer will operate accurately, even though you vary your output power over a large range, the above information should prove sufficient for you to make your own

adjustment. Keep also in mind that the swr coupler is more sensitive at higher frequencies, and thus a 10 Watt 2 meter signal may provide a higher voltage output than a 500 Watt 80 meter signal.

2) *Adjustment of R3.* Still keeping the V_R input grounded, adjust R3 so that the LED readout reads 01.0 with the transmitter keyed.

Explanation: With V_R equal to zero, the swr is 1. This adjustment matches the two voltage-to-frequency converters so that, with the same input, they provide the same output frequency, which is indicated as an swr of 1 on the display.

3) *Adjustment of R2.* This can be done in several ways, depending on the accuracy desired. The more accurate methods are more tedious, so we will give several ways, starting with the least accurate.

(a) Connect both the V_F and the V_R inputs to the forward voltage output of your directional coupler or swr bridge. Starting with R2 at the grounded end, key the transmitter and slowly adjust R2 while observing the displayed swr get larger and larger. Eventually the display will start to flicker at a slower rate, and at some point will blank out altogether. Adjust R2 just at the point where the display disappears.

Explanation: With the forward and reverse voltages the same, the theoretical swr is infinite since the difference V_F - V_R is zero. This adjustment sets R2 to the point where the difference voltage-to-frequency converter just stops working because it's getting zero input. This method of alignment does a good job at aligning the computer, but it ignores possible differences in coupler (bridge) sensitivity in the two directions. This might be a problem if the swr bridge's meter and 10k pot are left connected, as this loads down one output more than the other. This can be overcome by loading down the other side with an equivalent resistance (in this case 10k).

(b) An alternative method of setting R2 is to use another swr bridge to measure the swr in the line, and then adjust R2 so that the digital swr computer indicates the same value.

Explanation: No explanation for this is needed, but note that a high swr is needed during this adjustment so that the reverse voltage is sizable; hence this may not be a very practical solution.

(c) Probably the most reliable yet practical way of setting R2 is to connect the computer to the directional coupler in the normal way, monitoring the V_F + V_R channel (either with a good meter across R4 or with a frequency counter at the output of the sum channel's voltage-to-frequency converter) and then adjusting R2 with the transmitter keyed so that the same sum reading is obtained both when the coupler is inserted into the coax in the normal way and when it is connected into the coax backward.

Explanation: If the directional coupler is connected into the coax backward, the forward and reflected powers should be the same; hence the two output voltages out of the coupler should be the same except for the fact that they appear on the opposite lead. But their sum should be the same. If one of the two channels in the coupler has slightly lower sensitivity than the other, the adjustment of R2 will compensate for this fact. But the overall accuracy you should strive for in this adjustment depends on how well the two 27k resistors connected to IC1 (labeled "1" in Fig. 2) are matched, since they determine how well the sum signal V_F + V_R is obtained.

4) *Overall calibration accuracy.* One popular commercial swr bridge rates its accuracy as ±5dB, whatever that means. Even if your swr computer is only matched to within 10%, or even worse, you can still see that this would be a tremendous improvement over the accuracy you can normally obtain with a commercial bridge.

Of much greater importance than the *absolute* accuracy, however, is the *incremental* accuracy. That is, we normally do not care whether the swr on a given line is 2.1 to 1, or 2.3 to 1. No reasonably priced method of measurement is going to guarantee the absolute accuracy of that number. But of prime importance is the change — or increment — in the swr as we make a small adjustment in the antenna or operating frequency. This is where the digital swr computer really outperforms the commercial bridge, since even a change in swr of .1 unit

is easily seen, and changes even of 0.05 unit or less can sometimes be observed, though not actually measured. The gist of this is that you should strive to match the 27k resistors and do the adjustment of R1, R2 and R3 as well as you can, but all is not lost even if you cannot do so because of lack of a good meter or other equipment. Even if the digital swr computer is only aligned to within 10% or worse, it is still a tremendous improvement over the conventional swr bridge.

Troubleshooting

Because the swr computer is built on a printed circuit board, construction is fairly foolproof. Most problems arise due to either bad solder joints or accidental shorts, or defective components.

After mounting all the components, check all your connections for solder bridges between adjacent pins for cold solder joints. Good wiring of printed circuit boards requires good thin solder (60% tin, 40% lead) with a rosin core, a small pencil iron of 25-40 Watt capacity with a very small tip, and great care.

Use the following procedure as a general guide for troubleshooting:

1. With no inputs except power, the decimal point on the center LED should light. If not, check the power supply. Check the +9 and -9 volt supplies, and check that the +5 volt supply is really very close to +5 volts.
2. Connect the V_F and V_R inputs to +1.5 volts from a dry cell. Starting with R1 and R2 both at the grounded side, pin 6 of IC3 should be near 0 volts, while pin 6 of IC1 and IC2 should be near -0.6 volts.
3. Turn R2; pin 6 of IC3 should go negative, and reach -1.5 volts when fully on. Turn it back to the grounded end.
4. Turn R1; pins 6 of IC1 and IC2 should both go more negative, down to at least -3 volts or more.
5. As you are doing step 4, the two voltage-to-frequency converters should be generating outputs whose frequency goes up as R1 is turned further away from ground. With a frequency counter, if you have one, you can monitor the frequency on either side of the 0.002 uF capacitors. Most scopes won't display the very short pulses here, but should show a nice triangular wave on the emitter of the appropriate unijunction transistor. Chances are that at least one of the two circuits will work properly, so you can then use it to tell you what should happen in the other one.
6. The output of IC4, pin 11, should be one-tenth the frequency of the input, pin 14.
7. The output of IC5b, pin 12, should be one-half of the frequency of the input, pin 1.
8. With IC7, IC9 and IC11 unplugged, the LEDs should display the number 888.
9. With IC5 unplugged and a temporary jumper between pins 5 and 9 in its place, and R1 near its ground end, the LEDs should count up, counting the output of the voltage-to-frequency converter.
10. IC5 pin 6 should be near +2.5 volts with barely visible pulses on it; IC6 pin 3 should be near ground, with barely visible positive pulses on it; IC7 pin 4 should be near ground when the LEDs are dark, and should be near +3 volts when the LEDs are lit.

The above operational checks will help you narrow down the cause of any problem, if necessary. Since the unit has four 7490 and three 7448 ICs, as well as three identical LEDs, interchange of these units should help to spot defective ones. A good reason for using IC sockets or Molex pins!

Modification

Exists there a ham who ever builds a project exactly as described? Here are a few possible parts substitutions and modifications which may occur to you.

1) T0-5 style 741 op amps can be used instead of the 8-pin DIP style for which the board is designed. The pin numbers on the T0-5 are the same as for the DIP package. 741 op amps are also available in a 14-pin DIP package, which has different pin numbers and would therefore require some changes. Dual 741 amps are available under the numbers 747 or 5558; however, again they do not fit the board layout and so some changes would be necessary.

2) The PNP and NPN transistor types specified can be easily substituted for. Instead of the 2N706 NPN transistor, you

may use any NPN silicon switching transistor, and others as well. This transistor is not at all critical, and even a 2N5172, which costs only some 15¢ or so (*list*) will do. For the 2N3638 you may substitute any PNP silicon low power transistor, but make sure that it has a good beta and low leakage, as a good quality unit is needed here – I used the 2N3638 only because it is cheap and I had some. But use the same type number in both voltage-to-frequency converters – matching is important here.

3) Other unijunction transistors can be used instead of the 2N4891 specified. I chose this one because it is a standard Radio Shack item and therefore easy to get. But again, make sure to use identical transistors in both circuits.

4) Common-cathode LEDs were used because their price is often slightly lower than common-anode LEDs. However, other LEDs can be substituted. Other common-cathode LEDs may require slightly larger resistors – check their spec sheets. Common-anode LEDs require the 7447 driver rather than the 7448, and a different connection. Other types of readouts, such as Numitron, fluorescent, or several others, can also be used. Alternatively, a separate printed circuit board, originally designed for the K2OAW counter, may be used if you wish to use MAN-1 type common-anode LEDs (see the K2OAW counter articles in the May, July, September 1972 and November 1974 issues of 73 Magazine for circuitry). Obviously, using common-cathode LEDs is a cheaper and easier solution than trying to adapt the layout to common-anode LEDs.

5) If you already have the K2OAW counter, or are planning to build it, you can use the counter as the digital readout for the swr computer. This will significantly reduce the computer's cost.

If the counter is used, you may omit IC4 in Fig. 2, *all* of Fig. 3, and all except the two diodes and two capacitors used to produce -9 volts in Fig. 4.

The K2OAW counter power supply can provide +9 and +5 volts to the swr computer. Adding the four parts specified above to the counter power supply will produce -9 volts.

The *sum* output from Fig. 2 is fed into the counter input, that is, into the low frequency input, in the same way as an unknown signal.

The *difference* signal from Fig. 2, which would normally go to pin 14 of IC4 for division by 10, now goes to pin 14 of IC29 of the counter instead. A switch will have to be put into the counter to select whether the input to IC29 comes from IC28 or from the swr computer. In operation, this switch would be placed in the swr computer position, and the Hz-kHz switch would be placed in the Hz position.

6) For some applications, you may not need readouts as high as 99; let's face it, most commercial swr bridges are not calibrated for swr's above 8 or 10. If a maximum swr readout of 9.9 is quite satisfactory for your use, you may remove the most significant LED as well as IC10, IC11 and the seven 390 Ohm resistors associated with this digit, and place a jumper between pins 14 and 11 of the IC10 socket to connect the overrange circuit directly to IC8. This simplification can save you about $5-6.

. . . K2OAW

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Full Break-in at 60 wpm?

With this device you can, with every tap of the key, mute your receiver, key a transmitter, and activate a sidetone oscillator for monitoring your CW, to achieve true, quiet, full break-in CW to 60 wpm, without using a TR switch. The gadget will work well with any station using a separate transmitter and receiver, and separate antennas; it goes together easily in under an hour. The cost? Under $1.50.

Parts needed for the device are: One cold chisel, about 30 feet of enameled magnet wire, and a $1.29 package of four magnetic reed switches from the local Radio Shack store. (Catalog number 275-026, or whatever you can find there with ratings sufficient to handle the key circuit on your rig.)

Close-wind the magnet wire in one direction, one layer, the full length of the chisel (or other bar of steel or iron), leaving about six inches of lead wire on each end. Tape the coil ends to keep them from unwinding, then lay the coil on a piece of wood or cardboard and tape it in place.

Open the package of reed switches carefully, being sure not to ruin the plastic "bubble" on the package, as it is one of the components of the device. Cut out the ends of that bubble, place it over the coil, and tape it in place. See the photograph.

The schematic indicates the wiring of the coil, from a source of dc (6-20 V), through the station key. A simple rectifier-filter circuit is shown in the event you cannot tap

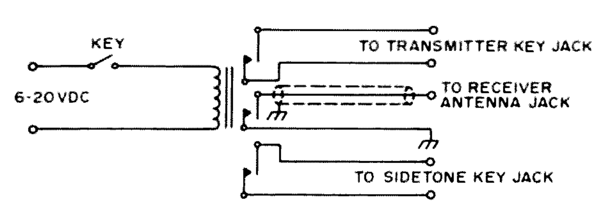


Fig. 1. Schematic.

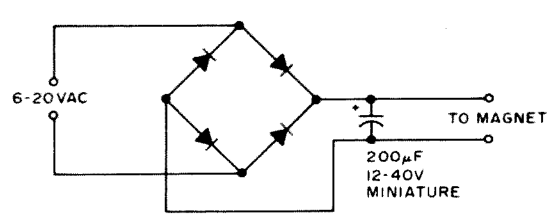
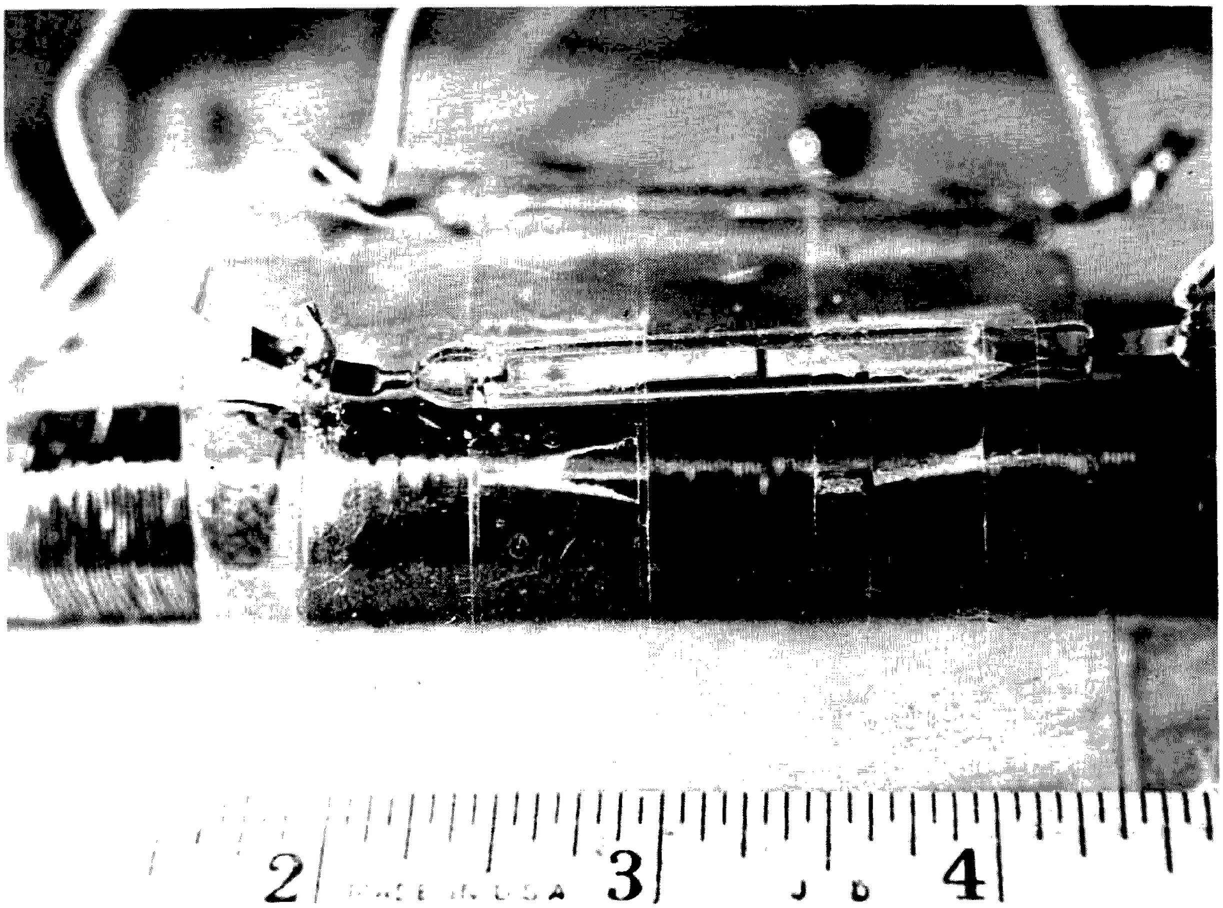


Fig. 2. Rectifier/filter for filament/panel lamp circuit use.



any dc, and must tap a filament or panel lamp circuit. Dc is a must. Granted, ac will produce a field around the coil, but reed switches will chatter in the vicinity of a rapidly changing field. A battery was tried, and worked well, but lasted only an hour. Portable operation with the device could be possible by keying the car battery to the magnet, through a resistor to eliminate the huge blue flash at the key that would occur without the resistor.

Once the magnet is wired, the bubble is in place over the coil, and a roll of cellophane tape is at hand, place the switches on the bubble one at a time while keying the coil. Find a spot where each switch pulls in every time you depress the key, and tape it on the bubble in that place. (Every switch in the package will respond a bit differently, and may have to be moved around on the bubble quite a few times before positive action is had from each switch.)

Note that the device cannot be mounted on metal, as metal will interfere with the magnetic field. Mount the device on a small board, on a wall, on a floor under the table, or wherever you can get at least six inches clearance from metal.

All that is left is to connect the circuits you wish to activate, or ground, to the switch prongs. One can key the transmitter (mount a key jack on the leads from the switch, and plug it into the key jack on the rig); another switch can short the speaker leads; another can short the receiving antenna to chassis ground; and another switch can be used to key a simple code practice oscillator for monitoring your sending. The number of circuits you can activate by keying the gadget is limited only by the number of reed switches you can crowd around the coil. You could conceivably mount the coil in the cardboard tube accompanying bathroom stationery, and mount switches around the whole circumference of the tube, if you had need for that much switching.

At this QTH, three switches are in use, and have been giving flawless full break-in operation for seven months, following keying faster than you can say -... ...-.

. . .WB6OMT

Byron H. Kretzman W2JTP
431 Woodbury Rd.
Huntington NY 11743

Odd Problems With an Old Antenna

You see, I have this summer place in the country, up-river, where I can escape from the rat race in the city. Actually, it is a year-round place, and I go up there just about every weekend, summer and winter. Built on the side of a hill, a big picture window in the den (ham shack, to you) looks out over the hill, sort of a plateau, covered with tall grass. After a week of the hustle and bustle of the city I can come up here, unwind, and really enjoy ham radio, in particular the chase of DX which has never paled for me.

Alongside the house a 75 foot telephone pole supports a full size five element rotary beam, a Yagi, for 20 meters. The receiver is highly sophisticated, and a chrome-plated linear amplifier permits the full gallon input on CW and 2 kW pep on sideband. It's CW that I enjoy the most, although I have more than 200 countries on phone. But, Asiatics have never come easy, phone or CW. Which brings me to this story.

One nice day, near the end of summer, I'm sitting at a table out on the patio making out QSL cards when one of the local fellows, a farmer, drives up to tell me about a county hamfest he and some other locals are planning. I invited him to have a nice cool tall one and to sit down and chew the rag; about DX, of course. I was bemoaning the difficulty in working the Asian stations, in spite of my beam and chrome plate linear. He sort of smiled (I never did find out how many countries he had) and looked out over the hill in back. "You know, son," he says, "If I had that much unplanted acreage and if I wanted to work Asians that bad, I would put up a rhombic!"

All next week I thought about that suggestion. A rhombic antenna. What ham used a rhombic these days? There wasn't much about this kind of antenna in the Handbook. No constructional info, but this statement, "Antenna gains of the order of 10 to 15 dB can be obtained. . ." So I did a little research on rhombics. An old World War II Signal Corps technical manual gave

me the information I needed. Well, I spent the balance of the summer and most of fall building a pair of stacked three-wire rhombics, one behind the other, and pointed in the direction of central Asia. Seven telephone poles, each about fifty feet high, supported these monsters, 7½ wavelengths long on each side. A weather-proof box on the rear pole housed a bank of high power terminating resistors. A two-wire transmission line, with a tapered transformer section to bring the 800 Ohm impedance of the antenna down to the 600 Ohm line impedance, led into the shack through two large bowl-type feed-through insulators in the middle of a glass window pane, which had been carefully drilled. A large ferrite balun transformed the 600 Ohm line to the 52 Ohm coax to the antenna relay in the linear.

At long last I was ready to try out this creation. An extra set of coax relays were connected to allow me to make an instant comparison with the five element Yagi. First I carefully tuned the low end of 20 with the Yagi, pointed towards Japan, switched in. The band was reasonably good. A fair complement of J's, KL7's and DU's were coming in S-4 to S-5. Then I switched to the rhombics. Looking at the panadapter, it appeared as if the ambient noise level had risen, but ihterestingly, the Asians heard just a few seconds ago on the Yagi had dropped down into the noise. Nothing from them could be heard. I continued to tune the band until I spotted a weak CW signal, barely above the noise. It was chirpy and it drifted quite a bit, but with the noise blanker switched on I copied him. He signed, "HS1RJ." I rapidly zeroed in the VFO and gave him a call. Nothing doing. He came back to a W6, giving his QTH as Siam. *Siam?* Then I lost him in the noise. I continued to tune. With the aid of the panadapter I found another weak signal, just above the noise, calling CQ. It signed MX3A. I gave him a short call but he came back to W8CRA and gave his QTH as Manchukuo. *Manchukuo?* Where the heck is that? Before the night was over I copied, and called, ZM1AA, PK1TT, XU6ST, KA8ZK and VS2AL. Not one came back to me! Dawn was breaking as I crawled wearily, frustrated into bed. Right after my head hit the pillow, I sat bolt upright as a thought banged into my head: There were no pile-ups around any of these stations! I collapsed and fell asleep without further consideration of that one.

Next weekend I went at it again. This time I concentrated on the high end of 20. Underneath the quacking SSB phone level I dug out such goodies as VU2EU, XU4XA and VS7RF. Out of the band, above 14,350, I found UK8IA and J8CG. I hugged the band edge and called them. Neither one came back.

Since there was little agreement between the Call Book prefix QTH's and QTH's given by the DX, I decided to write the DXperts in Newington to see if they could explain this. Also, since none of the stations came back to me, I figured maybe I needed a little bit more power. That's when I remembered Big Bertha. Big Bertha was built about 10 years ago, when I was living with my folks in the city. It is very efficient, much more so than any linear, because it runs Class C. A pair of 4-1000A tubes in push-pull are in the final. (I moth-balled it because the ac power lines in the city were just not stiff enough. Lights dimmed for blocks every time I pressed the key.) At that point I decided to take a week's "vacation" and get Big Bertha up to the summer place where the ac came from a nice, stiff, REA line.

I won't go into the details of getting Big Bertha trucked up and moved into the shack. It wasn't easy. Neither was its installation, which took the rest of the week. But, there it was, on the other side of the room, across from the operating desk. Ducting and a ventilating fan was put in directly above the big cabinet to take the heat out through the roof. Input to the king-size plate transformer primary was controlled by a variac on the front of the rig, its knob as big as a steering wheel. The two-wire spaced feeders were now brought directly into the cabinet through a pair of big bowl insulators to a huge 2-pole antenna relay. Its transmit contacts went to the swinging link of the tank coil and the receive contacts were connected to the ferrite balun for the coax to the receiver, via the switching relays mentioned before.

It was late Sunday night before Big

Bertha was ready to go. A storm was brewing in the west. Lightning was flickering on the horizon but when I turned on the receiver the QRN had not as yet built up. Nothing but noise was coming through on the rhombics. I tuned around for a long time. The storm was getting closer. The thunder, and the QRN, was building up. Then I heard it, weak but above the noise, calling CQ. AC4YN. Quickly I had the vfo on him, switched it into Big Bertha, and gave him a short call. The plate voltage meter read 3,300 volts. Nothing doing. Another short call, this time with 5,000 volts. Nothing doing. The storm was right overhead now. The thunder had become crashes. Another short call, this time with 6,500 volts. Then, *Whaap!* A ball of lightning came in on the feeders with the roar of a freight train, smashing into Big Bertha like a mortar round. Steel flew around the room like shrapnel, for the most part missing me because I was momentarily unconscious behind the desk. When I came to, the rig was a molten mass of glowing metal. Every light in the house was out. Through the picture window I saw that the center pole with its yardarm was a flaming cross etched against the black stormy sky. Flames were also licking at the ceiling where the fan had been so I struggled to my feet, grabbed the CO2 extinguisher and cooled things down as quickly as I could. Then the rains came. With the aid of a flashlight I reset the house lighting breakers, all of which had been tripped.

The rain stopped as quickly as it started. I spent the balance of the night patching the roof and putting in a plywood panel where the feeders had come in through the window. And, occasionally squirting the fire extinguisher at the still hot pile of debris. The smell of burnt bakelite permeated the whole house.

In the morning I shoveled the mess that had been Big Bertha into a wheelbarrow and gave her a decent burial in the back 40. Walking out on the hill afterwards I found that not a scrap of wire was left, just broken and blackened insulators. The terminating resistor bank, and its dog house, were completely gone. The blackened center pole was still smouldering, in spite of the rain. A very disheartening sight. As I turned to go back down the hill I noticed the mail man's truck coming up the road.

There was just one letter that day. From Newington. Scrawled with a felt pen across my letter to them were these words, *"Who are you kidding? These stations haven't been active in 35 years! Most of the ops are Silent Keys!"* That did it. I cleaned up what was left of the mess, closed up the house and headed back to the city.

Epilogue

It wasn't until next Spring that I had the heart to go back up the river to the summer place. But, a ham is a ham is a ham. Over the summer I rebuilt the rhombics, this time with a big outside grounding switch and with underground coax feeder. The chrome plated linear was back on the desk. However exotic DX calls out of the past were never heard again. Those Keys were really silent now. What little Asiatic DX I did hear now and then was only one or two S-units better on the rhombics than on the Yagi; and, I *did* manage to work a few. . . . W2JTP

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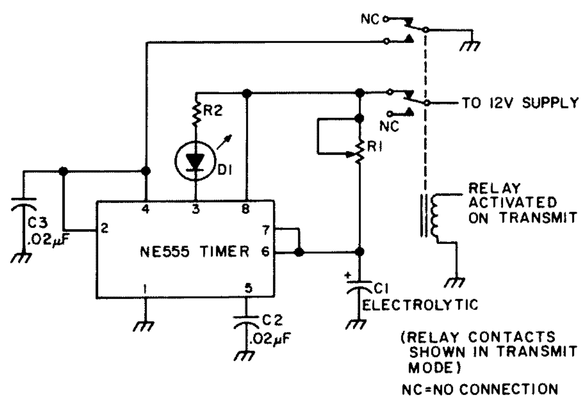
The Alligator Squelcher

This is a simple project which can be built in an hour or so and requires no exotic parts or bottomless junk box. If you buy every part new, the cost is less than $6.00 at any electronics hobby store, such as Radio Shack, Lafayette, etc. The heart of the time-out timer is an NE555 timer, wired to turn on after the pre-set interval. After the transmitter has been keyed for the preset time, the indicator light (or bell, or cannon) will come on and let you know that your time is up, and you should now (1) let the repeater drop; (2) ID; (3) replace your sweep tube finals which have just gone west; or (4) all of the above. None of the component values are particularly critical, so you can substitute freely.

The purpose of the relay is two-fold: One set of contacts resets the timer at the end of each transmission; the other contacts apply voltage to the timer during a transmission, so the circuit will be completely off during receiving. C3 keeps transients from re-triggering the timer. C1 and R1 together determine the time interval. I used 10 microfarads and 5.6 megohms for a delay of about a minute and forty seconds. Most electrolytics are *not* the exact capacitance they are supposed to be. In fact, they may vary as much as minus 50% to plus 100% in an actual circuit. If you want this to be a ten-minute timer, then in theory a combination of 100 microfarads and 6 megohms would give a 600 second delay, but in practice you will have to fudge a bit. In any event, when you try it for the first time, just push down the plate of the relay rather than key the rig. It saves wear and tear on the finals, and you won't be QRMing anyone while you're finding the correct setting of R1 for the time interval you want.

If you use a light emitting diode for the indicator, you will need a current-limiting resistor, R2, and a value of about 150-200 Ohms is OK for a 12 volt supply voltage. An incandescent bulb that draws up to about 100 milliamps will work also, and you won't need the limiting resistor R2. If you would rather have an audible alarm, most hobby stores stock a small code oscillator module manufactured by Carl Cardover for 98 cents.



R_1 – Miniature PC board potentiometer

R_2 – 150-200Ω (not used unless an LED is also used at D_1)

$C_{2,3}$ – Disc ceramic

D_1 – Light emitting diode, or incandescent bulb, such as #47 pilot lamp

Fig. 1.

In place of a light, wire the module so the positive terminal goes to pin 8 of the 555 and the negative terminal goes to pin 3. As a last resort, if you're the type that ignores everything while you're talking, you could hook up another relay to pins 3 and 8 that would cut off power to the rig at the end of the time interval.

Layout of parts is not critical, so long as you keep the project down to a reasonable size. Just remember, having very long leads in a circuit near an operating transmitter is asking for rf pickup. I used a 14 pin integrated circuit socket as both a terminal strip and IC holder. The extra pins can be cut off, or used to attach the circuit to the rig.

Before trying my circuit out in the transmitter, I hooked everything together with clip leads, and cut and tried until I found the right value of resistance of R1. This done, the completed circuit worked right the first time when put in the rig, something I only dream of for most of my projects.

. . .WB8EQQ

Herb Schoenbach W9DJZ
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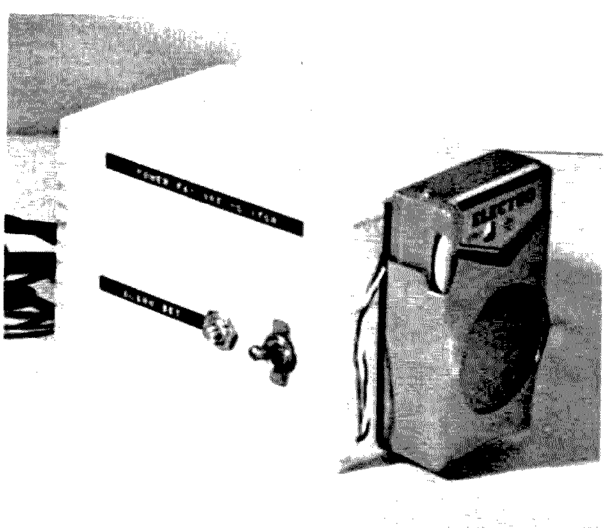
Downers Grove IL 60515

You Don't Have a Power Failure Alarm?

You probably need a power failure alarm. Why don't you have one? You haven't seen one for sale? Then why don't you build one? You just don't think it's worth the trouble for one or two power failures each year. And after the lights come back on you just know it won't happen again for a long time.



Front view, PFA. A larger box would allow radio to be placed inside.

Well, that is exactly how I felt about PFAs (power failure alarms), until about six years ago when I found just the right assortment of parts to make one. This little warning device has done such a good job for me that I have not even "improved" it, and that is unusual at my shack.

What It Will Do

The device I built is somewhat different from others I have seen. Here's what it will do for you:

(1) If power fails while you are asleep it will gently awaken you with an audible signal so familiar sounding that it will not scare you out of your PJ's at 3 a.m. some morning. . . no bells, sirens, buzzers or whistles.

You can then set your trusty wind-up alarm clock or sit up and read some back issues of this magazine.

(2) If power fails during daylight it will warn your MYL (in case she was scrubbing floors instead of watching TV, which would have also warned her).

(3) If power fails while you are all away from home, you will know about it as soon as you return. The GENTLE alarm will be on, even though power has been restored in the meantime. Without the PFA you might have gone to bed and not noticed the electric alarm clock was 45 minutes slow.

(4) If your electric service never fails (you dreamer!) this project is still not a total loss because you can use this PFA as a spare radio. . .just flip the switch.

Here's what it will not do: (1) It will not sound an alarm every time the lights flicker in a storm. There is a three second delay before the alarm trips. (2) It will not recharge or replace its own battery. . .you have to do that about once a year.

Construction Notes

Now let's get on to some of the details of this PFA. The assortment of parts I mentioned before includes a wooden file box, a retired transistor radio that still works, a fresh 9 volt battery, a sensitive relay, a momentary contact push-button, and parts to make a small power supply. Throw them together as shown in Fig. 1. Construction can be plain or fancy according to your taste. A small purchased power supply will save you some labor but will raise the cost.

The radio used should be a 9 volt type; otherwise, you may have to modify the circuit. Prepare the radio by removing its battery and bringing out the power leads. The file box should be made of wood or plastic so the radio's antenna will not be detuned, and so the radio can be placed inside, if desired.

A cigar box might also be a suitable cabinet. I attached the radio to the outside of the file box as shown in the photo. The relay should be the small, sensitive type rated at 9 volts or less and drawing less than 20mA. This will keep power consumption to 200mW plus transformer losses. If the relay coil is rated lower than 6 volts, use an appropriate dropping resistor in series with it.

The power supply, if not a ready made item, should be enclosed in a metal case for safety. Use a ½ A fuse in the line and a UL

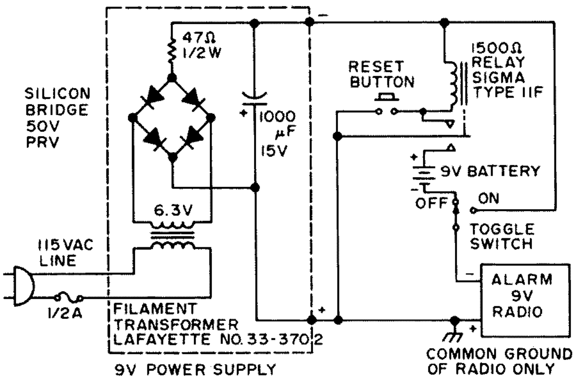


Fig. 1. Schematic of simple power failure alarm. The 1000μF electrolytic capacitor should be increased in value if a longer delay time is desired.

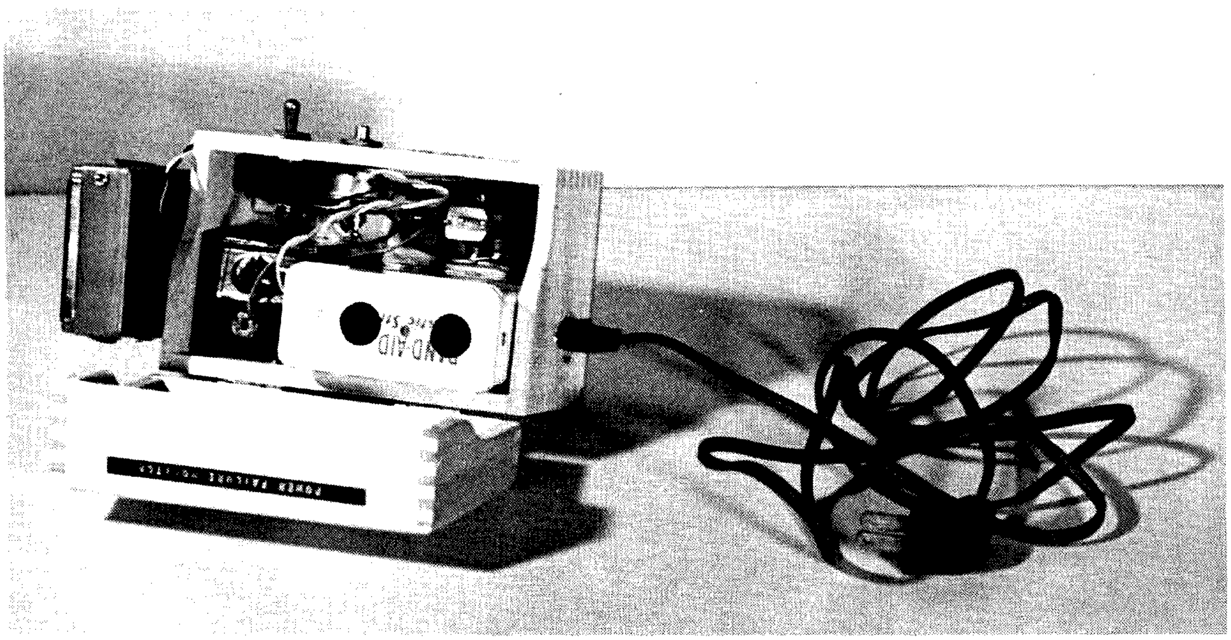
approved cord. Make certain your 115 volt wiring is well insulated! Remember, you are constructing a piece of equipment which will be connected to the power line 24 hours a day. It can be safer than a table lamp if it is built well.

By now you have probably figured out how it works. The relay is normally held energized by the 9 volt power supply. When 115 volt power is cut off, the filter capacitor will hold the relay energized for about three seconds. After this delay period the relay drops out, or de-energizes, and connects the 9 volt battery to the radio which has been carefully preset to your favorite 24-hour-a-day radio station at a GENTLE volume. In case you live where there is no dependable 24-hour-a-day station, set it to a station that comes on early enough to get you to work on time.

The battery problem is one of the drawbacks of this PFA. You can either buy a new battery for it once a year, or else keep rotating. When some other radio needs a battery, use the one from the PFA and put the new battery in the PFA. The PFA battery will usually not wear out unless you take long vacations. I used a large D6 size battery and actually the 2U6 would have done the job. The large batteries seem to deteriorate with age about as fast as the little ones. If you do insist on having a battery-less alarm, a clever one is described by Frank H. Tooker in *Popular Electronics*, February, 1968.

Operation

Operation of the PFA is simple but confusing to write about. PFA unplugged



Inside of PFA. Power supply is in BAND-AID® can.

and switch "off" causes the radio to play from battery, which is the alarm condition. If you now plug PFA into a live 115 volt ac line, the radio should continue to play from the battery. Push the reset button. The relay should latch causing the radio to go off. This is the normal condition: power is on, switch is "off", and radio is off; the alarm is set.

Now test the PFA. Unplug the cord for two seconds and reconnect. . .nothing should happen. Unplug the cord again and in 2 to 5 seconds the radio should start to play. When you have the PFA working right, it is a good idea to tape the radio's volume control and tuning dial to prevent accidental misadjustment.

Let's take some actual situations. Electric service is interrupted for ten minutes while you are away. When you return the lights are working, the refrigerator is running and everything seems normal, except the PFA radio is playing.

Simply reset with the push-button, set all your electric clocks and wait for the next power failure. Let's say you are at home when that happens. It is daylight and you might not know that power is off. But the PFA warns you immediately.

If you want to be alerted when power is restored, flip the switch to "on." This now turns PFA radio off. When power returns you will hear the radio again. Now turn the switch "off" and push the reset button. Should you want to catch a news or weather report while power is normal, just turn switch to "on" and now, believe it or not, the radio will play. But if you have a power failure now the radio will stop playing. See what I mean about confusing? It is really much simpler than it sounds. After all, with only two controls, it doesn't take long to try all the combinations.

After you install this PFA in some remote nook or cranny of your house, you should forget about it, and you will forget, just as my wife did. Her first experience with the PFA was about six months after I had placed it on a high shelf behind some pictures. One afternoon she was completely perplexed by mysterious music in the house. Cautiously tracing the sound to its origin brought her face to face with the PFA, clearly labeled: POWER FAILURE MONITOR. She then realized the electricity was off. But alas! She didn't shut off the PFA by turning the switch to "on." No, she very sensibly and simply turned the radio itself off. Now you know why I said to tape up the radio's volume control.

In six years of operation my PFA has never failed to signal a power failure. The situations mentioned before have all occurred in our household.

. . . W9DJZ

Alan Smith W8CHK
3213 Barth Street
Flint MI 48504

Portable QRP Power Unit

One of the very attractive advantages of QRP operation is its built-in potential for ultra-portability. The easy way a 3 or 4 band CW transceiver fits into an underseat flight bag speaks volumes for the tote-ability of these little gems.

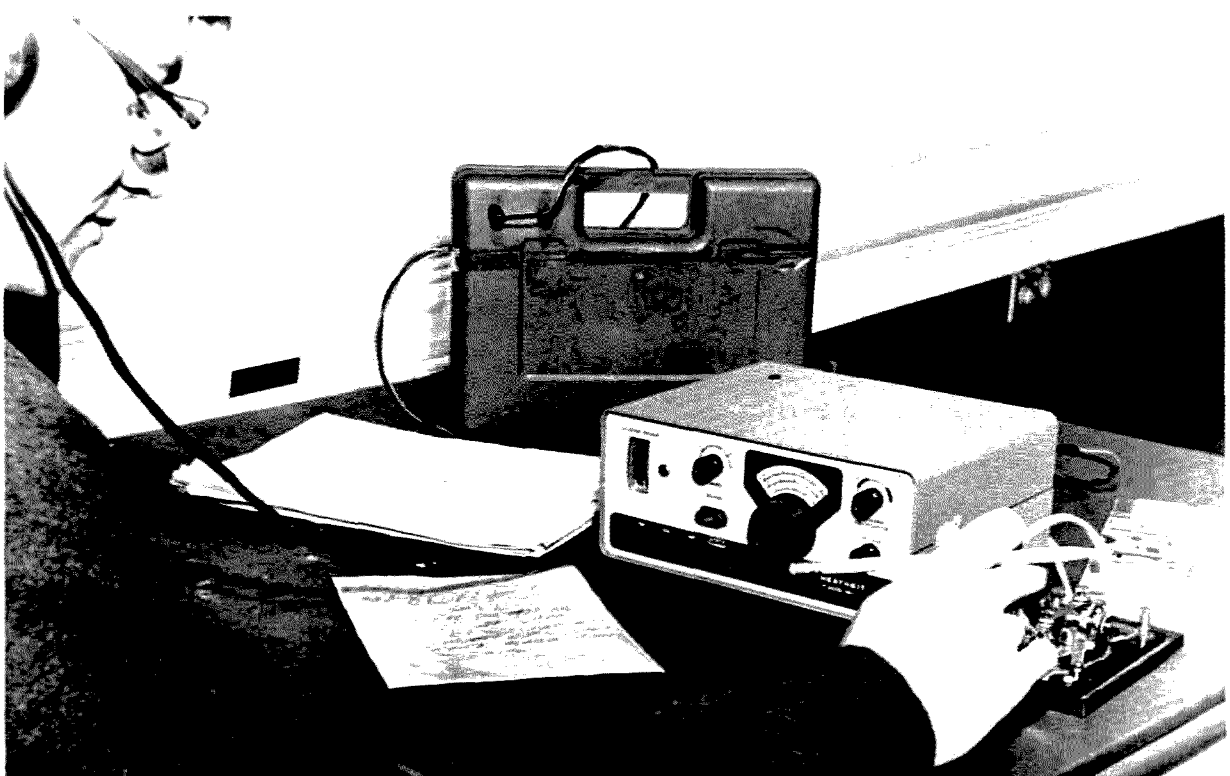
In truth, these rigs can be taken anywhere as handily as a lunch bucket or a briefcase. And with a little imaginative antenna work, you can be on the air as fast as you can say Wayne Green 73 times.

Maybe even faster.

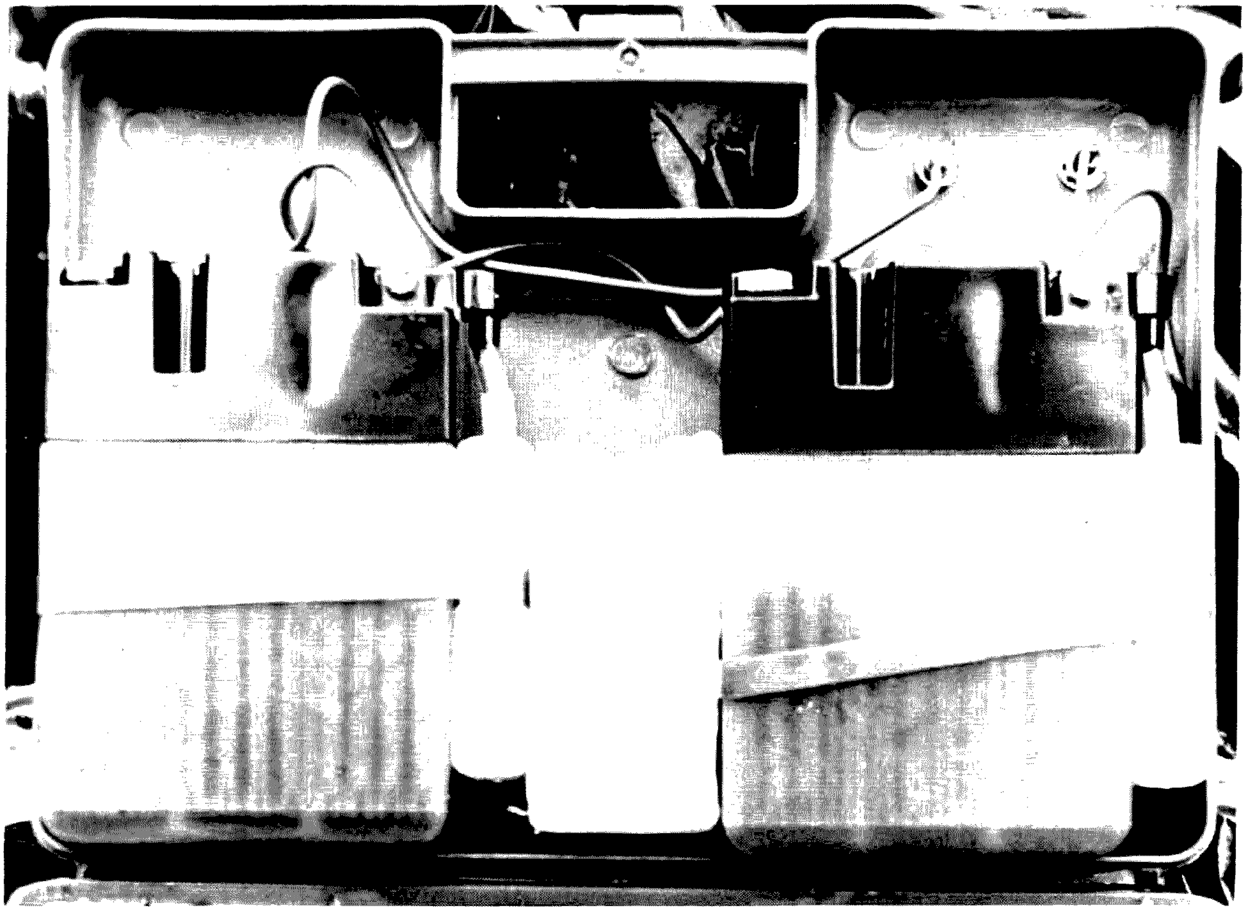
Now these QRP transceivers don't require much in the way of fan cooling, but they still need a little punch from a friendly power source.

Most often, power is supplied at 12 volts dc. This is easy when 120 V ac is at hand, but the implication of QRP is that it may be used at a QTH many furlongs from a high line.

Of course, 12 volts is also available wherever you can take a car, but when you are really out there, up there or down there, the choices all add up to batteries. And there



Mark Smith WB8KKZ and battery pack get it all together.



12 volt battery pack.

are batteries and batteries. Some are cheap, some expensive. The rechargeable variety is usually the most costly, although the recharging angle brings the cost per hour down.

Dry cells are, as everyone knows, an easy answer to the portability question. But the right dry cells are not available just anywhere and when they are dead, you throw them away. There is, however, another way to go. What is needed is a compact, heavy duty rechargeable 12 volt supply obtainable without giving up your last Picasso in the process. It is really quite simple. All you have to do is assemble a small lead-acid storage battery pack from easily available parts.

First on the bill of material is a brace of the 6 volt miniature lead-acid batteries now being marketed at many electronic parts outlets. Olson sells one for a very reasonable price. The Olson battery measures 5½ x 4½ x 2½ inches and is rated at 6 Ampere hours. Hook up two of these in series. Fit them into a cast-off plastic carrying case such as is used to package certain brands of soldering guns (Weller and Montgomery Ward) and you are ready to go.

The Weller and Montgomery Ward cases are sized exactly right to house two Olson batteries plus a styrofoam spacer to keep everything snug. A couple of *color coded* pin jacks installed in one corner of the case provides easy access to the 12 volt output.

The battery pack pictured here is housed in a Wards soldering gun case. Starting with a full charge, it was used to power a Heath HW-7, also shown, during a 2 week Michigan camping trip. The rig was used off and on each day by two operators. At the end of the 2 weeks, good signal reports were still coming in although the batteries had not been recharged.

Electrolyte leakage, the curse of lead acid batteries, is well controlled in the Olson battery. During the 2 week camping trip the batteries remained perfectly dry on the exterior. And considering the generally rough treatment handed out, this is quite a feat.

Nickel-cadmium batteries of the same capacity are much more expensive. Although they have the advantage of not having free electrolyte to worry about spilling, they have their own private curse. This is the polarity reversal gremlin that almost always appears when a ni-cad is depleted until the voltage drops. This is an expensive curse because polarity reversal ruins the affected cell.

A new plastic carrying case for the batteries can of course be obtained, along with a soldering gun, wherever such battery items are sold. If you are already the proud owner of such a soldering gun, but can't find the case it came in, Montgomery Ward is the best place to try for a replacement. You might also try "The Cooper Group," PO Box 728, Apex NC 27502 (cat. no. PUC20, $3.00).

This pack will quickly suggest other uses: lighting, rocketry, test bench and so forth. We even use ours to check out the trailer brakes before hitching up to the car.

Your list might be even more interesting.

. . . W8CHK

Eugene Fleming WØHMK
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Colorado Springs CO 80909

You CAN Fix It!

The rest of the family is in bed. You sit at the kitchen table soldering the last connections in place. You sigh, a little in relief at completing the project. But it is more in anticipation of seeing results from all the time last weekend and a couple of evenings this week, plus the wad of cash you put into that gadget in front of you.

You check the controls. The power switch is off. You connect the battery and reach for the switch. The moment of truth has arrived. It's time for those assorted parts so carefully assembled to spring to life. SNAP! goes the switch. Then nothing. No gurgles. No blurps. None of the squeals and howls for which hams are so well known. Thank goodness it didn't smoke.

You unplug the battery after turning off the power switch. A quick visual scan for loose wires or a bad solder joint gives no clues. Poking the wiring is just as fruitless. Sigh again. This time it is in disappointment bordering on disgust.

Every builder knows this scene. And engineering technicians report that hobbyists and experimenters do not have a monopoly on it. The simple fact is that few pieces of electronic equipment that have more than six or seven interconnecting parts operate properly the first time they are turned on. This applies whether they are one-of-a-kind home built gadgets or assembly line produced consumer products. Texas Instruments has a large, well-equipped lab designed for fault detection and analysis in items ranging from single components and circuit boards to finished products. Other manufacturers surely have similar facilities.

If the pros have this problem too, the weekend homebrewer need not berate himself for his stupidity when he throws the power switch and nothing happens. But where does he go from there?

In order to answer that, let's back-track just a little. The builder assumed that he used parts that are in operating condition. As nutty as a bunch of us hams are, it is hard to imagine one intentionally installing defective parts in his own project. If he checked each part on a suitable instrument, his problems are a little different than if he did not test them.

A personal example will illustrate this principle. During the time since the original draft of this paper was written, the writer was asked to check out a transceiver for a friend. When one of the 6146s was found to be shorted, the owner decided it was a good

time to replace them both. New ones were purchased and installed, without being tested. Yep, you guessed it. The rig wouldn't work properly. Before tearing deeper to see if the original defective tube had caused other circuit damage, it was decided to put the tubes on a tester. Sure enough, one of them showed a heater to cathode short. The rig worked fine when two tubes that gave a proper indication on the tester were installed.

It will have to be assumed that each part has been checked before installation.

Step One: Carefully look over the wiring to spot poor connections. If there are none, trace the wiring carefully to be sure it matches that in the schematic of the project. However, if the project is a multi-stage affair, circuit tracing may be deferred until the faulty stage is localized as described below. In any case, circuit tracing is best delayed for at least 24 hours after wiring is completed. This gives the builder a chance to forget some of the details and approach his work with a mind not quite so cluttered with details he is sure are correct.

Step Two: Reread the discussion of "how it works" in the article from which the project was built. A knowledge of the theory behind the hardware will save much fruitless poking and prodding. It will give meaning to voltage and resistance measurements to be made later. If your project was built from a scrawled schematic supplied by a friend, try to locate something similar in a handbook or the annual index published by most electronics magazines. Time spent in this way not only can save time in the repair, it might also help you answer some of the questions next time you visit Fox Charlie Charlie.

Step Three: Bring out the test equipment. Exactly which instruments are needed depends on the nature of the project.

The homebrewer should have access to the best multimeter he (or his friends) can afford. He will probably choose to own it if he hopes to do a great deal of building his own or servicing of commercial equipment. "The best he can afford" does not necessarily mean buying the most expensive model in the catalog. A friend or ham club may have equipment he can rent or borrow. Digital instruments are nice, but a used volt-ohmmeter picked up at a flea market can often do the same job. It has the added advantage that there are fewer parts inside it

that might need fixing before checking out the latest project.

The following suggestions can serve as a general guide to troubleshooting and give a general feel for the procedure. In this type of presentation, it is not possible to give details required for a specific project.

One of the few things common to all electronic equipment is a power source. Check it to learn if it is producing the needed voltages at its output. To do this, set the range switch of the multimeter to the highest voltage expected. This might be the 10 or 15 volt dc range if a 9 volt battery is used as the power source. It would be the 150 volt dc range or next higher if rectified line voltage is used to supply the power. Connect the negative (-) probe, which is usually a black lead to the negative side of the power supply and the positive (+) to the positive output of the power source. A beginner should do this before turning on the power switch to avoid the shock hazard.

If there is no output voltage or it is quite low, the supply may be faulty or there may be a short in the load causing excessive current drain. To determine which it is, disconnect the load (with power off, of course) and measure the output voltage in the same manner. A normal voltage will indicate a properly functioning power supply.

An important exception to the last statement is that a stale battery can show full voltage at no load, but drop to practically zero when put under even light loads. Most batteries can be checked by connecting only a thousand Ohm resistor across the terminals and measuring the voltage across it. If that voltage is more than half a volt below the rated voltage of the battery, it is best to replace it. Keep in mind that a short in the load could have caused the demise of the battery, so check before installing a replacement.

In the case of an ac supply with rectifiers, check the line input voltage. To do this set the multimeter on the 150 volt ac range and connect either probe to one side of the transformer primary and the other probe to the remaining primary lead. Then turn on the power. The meter should show a reading between 110 and 120 volts. This procedure

can be skipped if there is a pilot light in the circuit which lights as it should. No voltage indication means there is an open circuit which can be found by resistance checks of the line cord, power switch or solder connections. The most common point where a line cord develops breaks is at the junction of the plug structure and the wire cord. This is particularly true of molded plugs. More than one old-timer has asked this writer to repair equipment with nothing more seriously wrong with it and then asked him not to tell others of the incident.

At the risk of being tedious to those with some experience, a brief explanation of how to make a resistance check seems in order. Set the range switch to low Ohms scale for checking wire continuity. Disconnect all power. Connect either probe to either end of circuit to be tested and the other probe to the other end. The power cord will show a fraction of an Ohm even for many feet of wire. A switch should show zero Ohms, if good, and the primary windings of most power transformers have resistance running as high as 500 Ohms or so. An eight Ohm speaker coil seldom shows more than a fraction of an Ohm at dc. Low voltage secondary of a transformer, both power and audio output, will show very low readings, usually less than a couple of Ohms. High voltage secondaries usually show several hundred Ohms of resistance. An extremely high Ohms reading in any of these circuits will indicate an open circuit. Transformer windings sometimes open at the point where wire from the outside connects to the smaller internal wire. At today's prices for transformers, it is worthwhile to carefully remove the outer insulation paper to check this point when an open winding is located.

To summarize on resistance measurements, the most important part is to know how to interpret the readings you obtain. This comes only with experience. Therefore, make measurements in operational equipment to gain a knowledge of what you should expect when you are working on malfunctioning equipment. Resistors are easy to measure, because the values are marked on them. On other components, it is worthwhile to make notes on values so they will be available for comparison at a later time.

Continued

Now back to power supply measurements. When a proper ac voltage is obtained at the primary input, the next step is to go to the various secondary outputs. Set up the meter for a full scale range slightly higher than you expect to read, connect the probes to the pair of wires coming from the winding, apply power, and note the reading on the meter. If there is none, check for open circuits. If it is too low, disconnect the load and check the voltage again. Check all secondary windings in this way. Lighted tube heaters or pilot light on a particular secondary show it is working, so don't bother measuring it.

Once you are sure the proper voltage is being produced by the power source, other parts of the circuit can be checked. However, if the output voltage is too low, it may be caused by a part of the load drawing too much current. Since most projects have several branches of the dc line, a logical procedure is to disconnect them one at a time, apply power with meter connected to read dc voltage at output of power source, and note if the voltage rises to normal. When it does with one branch disconnected, that branch should be checked for wiring errors or defective parts. This approach will save much time in comparison to tracing the wiring in the entire project.

Although the foregoing explanations are somewhat cumbersome, the tests, with exception of the previous paragraph, can be performed in less time than it takes to read about them. Experience has shown that these simple measures can put about 75 percent of home built projects into operation when no defective components have been installed. Another 20 percent require signal tracing or injection which will be discussed in a future article. Most of the remainder have a component damaged when power is switched on because of a wiring error.

In conclusion, do not be afraid to tackle the chore of finding where the problem lies in that newly built project. If you had knowledge enough to put it together, there is a good chance you can make it operate, even if it failed the smoke test.

. . . WØHMK

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Precision +10.000 V dc Voltage Reference Standard

This article describes a simple, easy to build dc voltage reference standard whose temperature coefficient (tempco) can be tailored to the ham's individual requirements. It can be used by itself or as an individual circuit element.

Design Considerations (see Fig. 1)

The circuit described uses an operational amplifier in a non-inverting circuit utilizing a single positive supply. The output of the reference standard supplies the zener reference diode current, providing a stable supply voltage for the zener and de-coupling from the positive supply voltage. The positive supply voltage should be regulated by either a three-terminal regulator or zener diode and should be from +15 to +18 volts.

Temperature stability is expressed in %/°C or ppm (parts per million)/°C. (.0001%/°C is equivalent to 1 ppm/°C.) A 1 ppm/°C change referred to an output of 10.000 volts is 10 uV/°C. Both terms, %/°C and ppm/°C, will be referred to in this article.

The zener reference diode, CR1, should not be confused with the more common zener regulator diode. The zener reference diode is intended for use in applications where it is important to maintain stable dc voltages under severe combinations of temperature, shock and vibration. The temperature stability of the zener reference diode is due in part to the combination use of reverse-biased and forward-biased silicon p-n junctions, taking advantage of their opposing tempco characteristics. Application notes and design data sheets are available from the larger suppliers of zener reference diodes (e.g. Motorola, Dickson, Centralab) and are invaluable as reference material.

The 1N821 through 1N829 family of zener reference diodes is used for CR1. The diodes in this family exhibit tempcos from .01%/°C (1N821) to .0005%/°C (1N829) at a nominal zener current of 7.5 mA. The nominal zener voltage is 6.2 V ±5%. R1, which sets the nominal zener current (7.5 mA in this case), should be a 100 ppm/°C metal film resistor. Other families of zener reference diodes can be used, such as the 1N4565 through 1N4584, with a corresponding change in nominal voltage and current.

As a general rule, the gain resistors used in the reference standard should have tempcos similar to the zener reference diode selected. For example, if the 1N821 is selected, gain resistors R2 and R3 should have tempcos of .01%/°C (100 ppm/°C).

The overall tempco of the reference standard is dependent upon the tempcos of the reference zener CR1, gain resistors R2 and R3, and to some extent, the zener current resistor R1 (providing it has a 100 ppm/°C tempco) and A1.

The gain required of the circuit is dependent upon the zener voltage. The nominal voltage of the 1N821 is 6.2 V, necessitating a gain of 1.613 for an output of +10.000

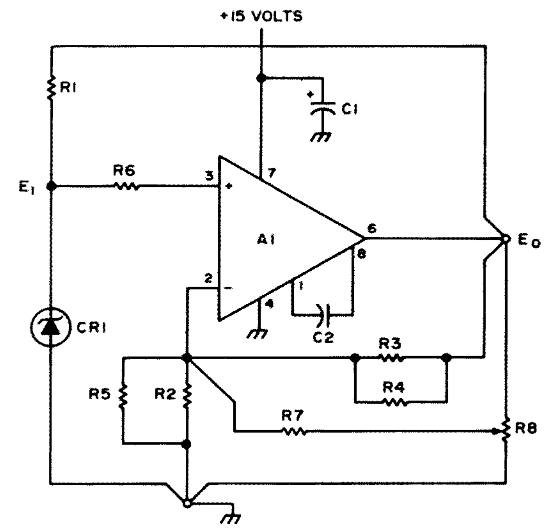
volts. The total resistance of R2 and R3 should be 5k to 10k, limiting the current through the gain resistors to from 1 mA to 2 mA.

If R1 is a 100 ppm/°C as suggested, here is an easy way to estimate the overall tempco of the completed reference standard: 1) Write down the tempcos of CR1, R2 and R3 in ppm/°C; 2) Square each one that you have written down; 3) Add the squares of R2 and R3 together, dividing the answer by seven; 4) Add the square of CR1 and the answer of step 3; and 5) Find the square root of the answer in step 4. Step 5 will be the approximate overall tempco of the reference standard in ppm/°C. This will give you a good idea if the components you have selected fit your tempco requirements. If CR1, R2, and R3 have the same tempco, just multiply the tempco of *one* of them by 1.1 to determine the overall tempco of the reference standard. The reason for the division by seven in step 3 is that the tempco of R2 and R3 is reduced a factor of approximately 2.7 (depending on the gain) by the low gain of the amplifier.

The output of the reference standard can be trimmed to +10.000 volts by paralleling a resistor across R2 and/or R3 as required. Tempco of the gain trim resistors, R4 and R5, is critical, and should not alter the tempco of the gain resistors. For example, if R2 was a 6.04k 25 ppm/°C resistor and a 62k ½ Watt carbon resistor was paralleled across it having a 1000 ppm/°C tempco (typical tempco of carbon resistors), the result would be the same as using a 5.5k 100 ppm/°C resistor. The effective tempco of the trim resistor in this case would be 1/10 its real tempco. A 620k ½ Watt carbon, in the same example, would have an effective tempco of 1/100 or 10 ppm/°C, and a 6.2 megohm would have an effective tempco of 1/1000 or 1 ppm/°C. Some discretion must be used when selecting the value and tempco of the trim resistors.

Practical Design

The next step is to build a working reference standard. The following components were selected for a reference standard having a calculated tempco of 22 ppm/°C and a measured tempco of 17 ppm/°C after assembly. An LM301A operational amplifier was selected for A1. The LM301A will supply approximately 20 mA and has a typical tempco of 1 ppm/°C. A 1N825 reference zener was selected for CR1 which has a 20 ppm/°C tempco and a nominal voltage of 6.2 volts at 7.5 mA. An RN55 100 ppm/°C 511 Ohm metal film resistor was selected for R1. The actual reference zener voltage at 7.5 mA measured 6.286 volts, necessitating a gain of 1.591 for +10.000 volts output. For a gain of 1.591, an RN55E 25 ppm/°C 6.04k metal film resistor was selected for R2 and an RN55E 25 ppm/°C 3.57k metal film selected for R3. A ½ Watt 2.2k 5% carbon resistor was



$$Gain = \frac{R2 + R3}{R2}$$

$$E_0 = E_1 \frac{R2+R3}{R2}$$

A1 – LM301A Operational Amplifier
C1 – 1 mF electrolytic capacitor, 25 W V dc
C2 – 30 pF ceramic disc capacitor
CR1 – Reference zener diode, 1N821 family
R1 – 100 ppm/°C metal film resistor (Select value for the nominal current of CR1.)
R2,R3 – Gain resistors (Select for desired tempco.)
R4,R5 – Gain trim resistors
R6 – ½ Watt resistor (Value should be the parallel equivalent of R2 and R3.)
R7* – Optional +10.000 volt trim resistor for use with R8 (Value can be 100k to 1 megohm, 5-10 ppm/°C.)
R8* – 10k 89PR cermet pot or equivalent optional +10.000 adjust.

*with a 100k resistor at R7, the output can be adjusted about 10% if the sum of R2 and R3 is 10k. 1 megohm will provide about 1%.

Fig. 1. Voltage reference standard schematic.

selected for R6. After assembly, R3 had to be trimmed for an output of +10.000 volts.

The most difficult task after assembly for the average ham will be finding access to a 4 or 5 digit digital voltmeter so that the reference standard output can be trimmed to +10.000 volts. No special equipment is required up to the trimming operation. The accuracy of the reference standard will be as good as the equipment used to trim it.

Conclusion

It has been demonstrated that a precision reference standard can be constructed by utilizing available reference zener diodes and suitable gain resistors. This article was written primarily as a tool to enable some of those interested in acquiring a stable dc source to design their own. Different output voltages can be obtained by either changing the gain of the amplifier or adding a voltage divider across the output of the reference standard (current cannot be supplied in this mode). Layout is not critical, cost is minimal, and performance can be determined to some extent before assembly.

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Building a 135 kHz i-f Strip

This article describes the use of the second surface of a baseboard for a 135 kHz i-f strip. I used the first side for the converter, 1.65 MHz to 135 kHz mixer, and the 1.785 MHz oscillator, which left the other side bare and ready for mounting the 135 kHz strip.

The first thing to do is the construction of the two terminal strips with their .021 diameter pins to hold the various components in place, such as the resistor tie points, capacitors, three pins for each transistor, interstage coupling capacitors, 12V bus, etc.

Fig. 1 shows placement details of these pins on the 3¾ x ¼ in. fiberglass strips which are .035 thick. As in my converter strip, 1/8W or 1/10W was used for resistors throughout, and small 10 mF electrolytics are also a must. There are two components which are still fairly large, the 135 kHz inductors and the mica compression trimmers, but even when these are mounted there is still lots of space available, as you can see in Figs. 5 and 6.

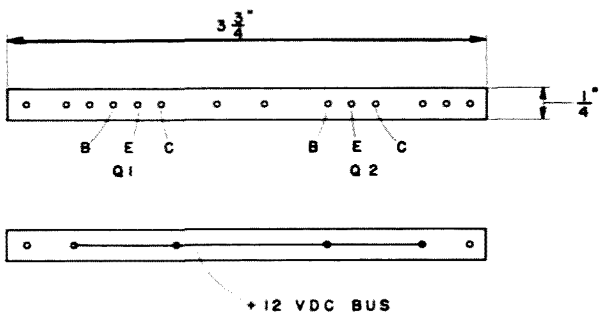


Fig. 1. Terminal pin layout.

Be sure to use the narrow type trimmers which are only 3/8 in. wide but still have 700 pF maximum capacity, which are the kind of values you need down at 135 kHz. As you can see, the 12V bus is interrupted at one end for the avc line, and on the other end has a 100Ω resistor for dc battery supply purposes.

The top line of terminals works out nicely with, from left to right, "S" meter connection, input to the base capacitor, base, emitter and connector pins, collector bus, interstage capacitor, second stage B, E, and C pins, diode one, and the output capacitor. Three more pins were needed for the avc diode and its associated avc components.

The HEP 55 Transistor

Practically in the middle of building and

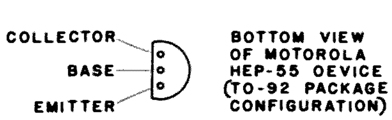
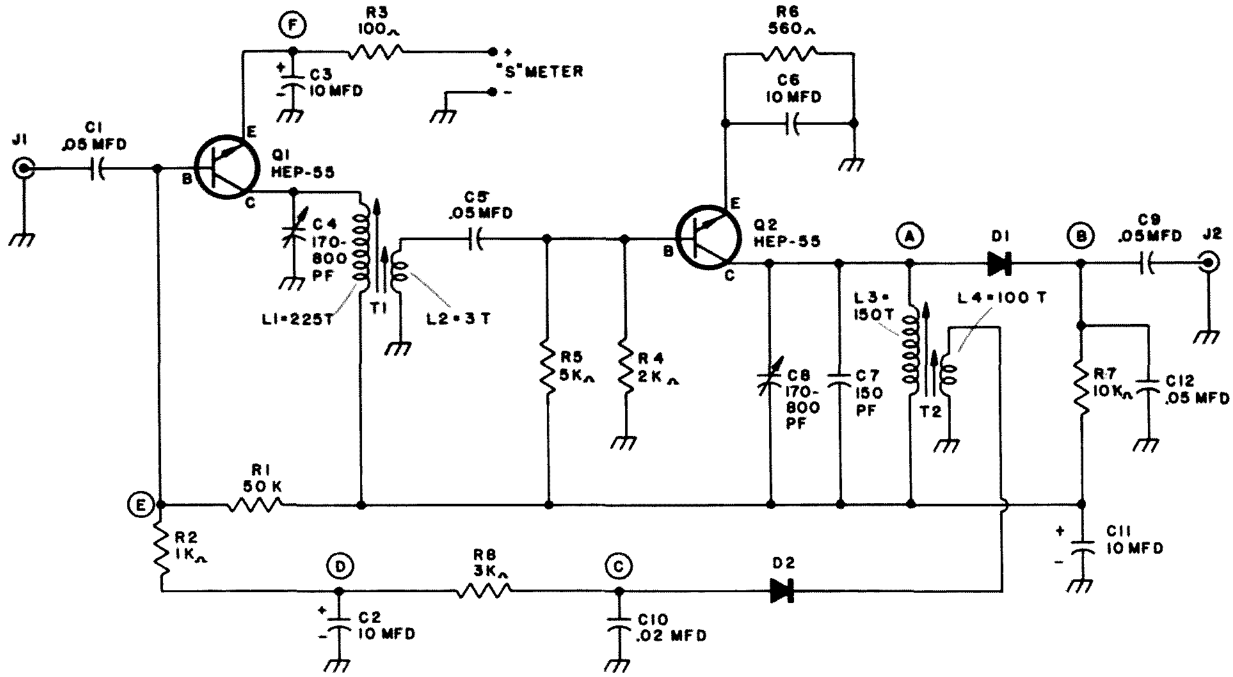


Fig. 2. HEP 55 pin connections.



NOTE: ENCIRCLED LETTERS DESIGNATE TEST POINTS

Fig. 3. 135 kHz i-f circuit.

testing this unit I received a shipment of goodies from Motorola. There were a bunch of HEP 55s in the box, and these look like the answer for use in all the stages between (and including) 135 kHz up to two meters.

I tried one (HEP 55) right away in the 135 kHz strip against a 918 and the increased gain showed up quickly.

Tubes used to have a fairly simple parameter called "Gm," or transconductance, which gave a pretty good idea of what the tube would do, at least on lower frequencies, with other things being equal. There are, to start with, some 100 symbols in fairly current usage for transistor parameters, but fortunately there is one that helps a lot as a preliminary indication, again on the lower frequencies. It is known as *beta*, using the common emitter circuit, and is simply the ratio of the change in output current to the change in input current that caused it. In an HEP 55 for example, a one microampere change in the input can become a 350 uA change in the output. This therefore is a hot device! Testing a number of them against 918s, 3600s, and various others, the HEP 55 simply amplifies more at 135 kHz. Don't get me wrong about the 918s, though: They are of course made for UHF work and the HEP 55 is listed for use up into VHF only.

The HEP 55 is good for 200 MHz, which is listed as Ft, the cutoff frequency, and so is good for nine stages in the 432er. These are the two at 135 kHz, mixer, oscillator, two i-f stages at 1.65 MHz, and the rf, mixer and oscillator of the tunable i-f at 28 to 30 MHz, otherwise known as the ten-meter-receiver section.

The terminal arrangement is not exactly ideal, but is satisfactory when mounted as in Fig. 2. It does have some good features for sure. For example, the base-emitter voltage is listed as five, which is better than the 918s which only can take three volts. Don't forget, almost any transistor can burn out a following one of the same type, so step down that impedance!

The dissipation of the 55 is 310 mW, which is alright in the receiver. The maximum collector current is listed at 200 mA, which seems higher than needed, but that's Motorola's affair.

At 200 MHz the beta is still around 250 or so and should thus be good for receiver work up to and including two meters.

As you know, if you have read many of my articles, I've always been looking for a universal transistor, out of the many thousands available, that can be used in almost every receiver stage up to two meters. This

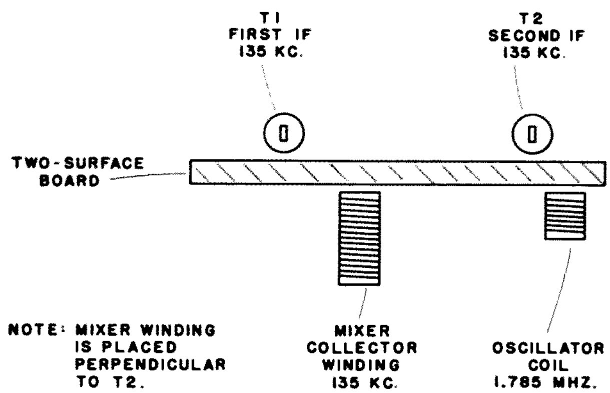


Fig. 4. Magnetic feedback prevention details.

does not include the low-noise rf stage or stages, for which you will have to pay a little more at present.

If further tests hold up, the HEP 55 may just be this universal device.

If you're going to de-breadboard a circuit and minibox it, go ahead, but *copy*, don't *change*! I did (change) and it cost me two extra days of hard work. I don't mind the time if you can profit by it, so here goes.

The final circuit is shown in Fig. 3, which looks almost like the one in my breadboard unit. It was supposed to be the same, but as soon as I turned it on – zilch! Insufficient avc action with af diode blocking on any signal over an S5. After hours of checking for proper avc voltage, milliamps of current with the signal generator on and off, I dismounted the original breadboard 135 kHz i-f and checked it for overloading. None – it was perfect. Alright, just what had I done, or changed?

After checking capacitors and resistors, diodes 1 and 2 were replaced. Still nothing. What remained? I had put in two of the higher gain HEP 55 devices for Q1 and Q2, so they were replaced with the original 918s. Still nothing. There remained only the "new" winding of 225 turns instead of the original 150. And that was it! As soon as I wound up another T2 using the original 150 turns, with 100 turns in the avc diode secondary for good measure instead of 80, bang, good avc again. Current in Q1, the avc controlled device, dropped to 10 uA with a good signal at the input.

So, once again, *don't* make changes when reducing the size, unless you're ready to do more experimentation, maybe several days of it, because the smaller you get the harder it is to change components.

More Avc Details

"Out of evil comes good," it says in the Good Book, so sure enough, while on the blocked avc trouble I was able to improve the avc circuit. Checking the circuit in Fig. 3, you will see R8 feeding the avc line. When only one diode is used for both af and avc, this resistor cannot be very small, but when a separate diode D2 is used, R8 can be of any value you want because it now serves just as a filter in the line and does not have to isolate the line from the af channel. The smaller you make it the more avc action you will have. You can see the balance needed between R8 and R1, the 50k resistor feeding plus voltage to the base of Q1. If you want more, or less, avc action with this circuit, you can juggle the values of these two resistors, R8 and R1.

The lower impedance of LI with 150 turns instead of 225 also gives a better match for Q2 making it more of a current driver into D2.

Table 1 shows representative voltage readings at significant test points for avc action. Readings at these points will vary somewhat depending on your voltmeter, transistors, etc. I used a small VOM but of course a VTVM would be better.

The Final Circuit

Every value given in Fig. 7 is exactly as in the working model which is completely

		Volts	
Point	To Point	Sig. Off	Sig. On
A	B	0	about 1V
C	GND	+.2	–.5
D	GND	+.9	+.3
E	GND	+ 1V	+.5
F	GND	+.5	close to zero volts.

Table 1. Avc voltage test points. Note: Signal "On" was the "Low" output from a Lafayette signal generator, output control full "On," through a 100:1 resistor attenuator, home brewed, frequency 1.65 MHz. No tuned circuit was used at 1.65 MHz – just a direct cable connection to C1.

enclosed in the 4 x 2 minibox and working well.

An output link on the 1.65 MHz to 135 kHz mixer comes through CI to the base of Q1, an HEP 55 Motorola NPN. Base bias is obtained as detailed in the avc section above, with emitter current going out to the "S" meter on a pair of red and black flexible wires.

The secondary of T1 was changed to 3 turns to drop the gain a little and provide more selectivity.

The circuit of Q2 is almost identical to the breadboard one, with another HEP 55 being used. The avc secondary of T2 is now 100 turns instead of 80, to provide more avc action, and R7 is lower for the same reason. The idling current of Q1 is about 5 mils, dropping to as low as 10 uA on almost any good signal. Needless to say, there is plenty of af out of J2.

Figure 4 shows the final placement of the mixer collector winding in relation to the collector winding of the first stage i-f, T1. Note that Q1 has its collector in T1 and its base in the mixer winding. If any coupling is present between these two it could provide a feedback path and oscillate. It did!

The magnetic field went right through the copper baseboard (naturally enough) just as though it weren't there, and Q1 made like an oscillator. Adding four small pieces of flexible wire (you can do this at 135 kHz but *not* at VHF) to allow moving the coil around, it was rotated in several planes. Sure enough, when parallel to L1 it produced nice, clean (but unwanted) oscillation. When mounted perpendicular to L1 as in Fig. 4, no feedback and no oscillation.

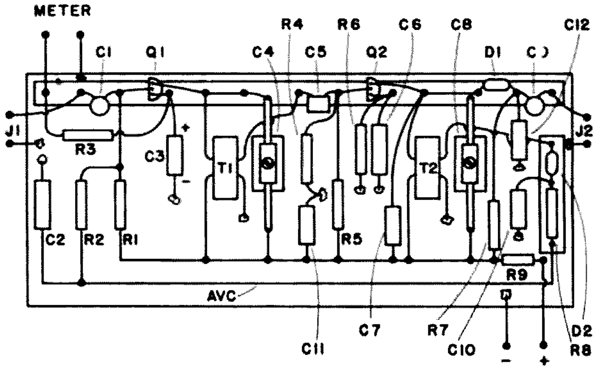


Fig. 5. Layout of the 135 kHz i-f strip.

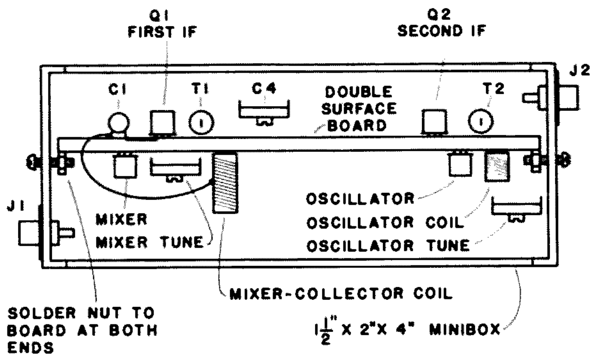


Fig. 6. Installation in a minibox, top view with cover off.

The Layout

Figure 5 shows the various components and how they are fitted onto the 3¾ x 1½ in. second surface of the baseboard. I clamped the board bare side up in a drill vise and proceeded with the entire assembly and tuneup on 135 kHz. I then brought just one wire over from the mixer transformer to Q1, and the 12V to the bus, and the two sides were in action together.

Looking onto this 135 kHz strip, you can see in Fig. 4 that there is still plenty of room left and so far nothing is covered up, with all the components in plain view. As mentioned, the transformers and trimmer capacitors loom rather large among the 1/10th watters and transistors, but I still can't believe the amount of empty space in that little box, even when I'm looking right at it.

Tuning Up

Referring to Fig. 3, the final circuit, the interstage transformer T1 tuned quite well over the range of 130 to 150 kHz with the mica trimmer C4, 170 to 600 pF. This inductor plus the mixer collector coil determines the 135 kHz center of the narrowband i-f. T2 is fairly broad with its close coupling to the af diode and also to the avc diode now with the 100 turn secondary. Both af demodulation and avc action are aided by this close coupling, so the sharp selectivity is left to the first two transformers.

With quite a bit more work and winding time you could add more tuned circuits, but this whole triple conversion receiver is enough of a project for now.

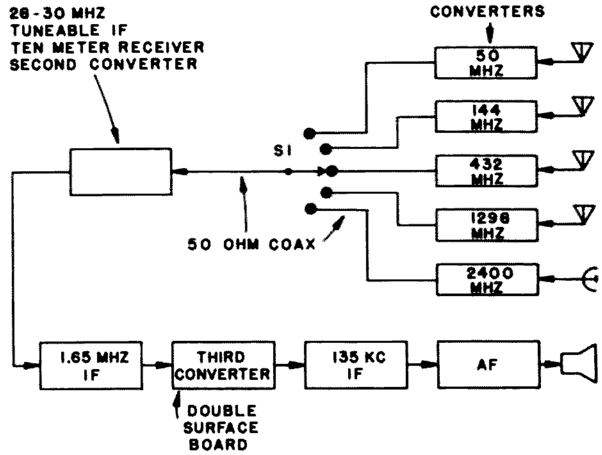


Fig. 7. Block diagram of an all-band VHF-UHF-S-Band receiving system.

The modular concept is still very evident. In fact, it's even more so now with each module consisting of an enclosed minibox instead of a breadboard. I'm getting quite curious to see just how small the whole receiver can be. Putting the entire rf section into closed boxes looms as the toughest size problem.

Installation in the Box

Fig. 6 shows a view looking down into the minibox with the cover off. You can see that with both sides of the box open, almost all the components are available for service if needed.

To remove the board from the box only two wires have to be unsoldered, one to J1 and one to J2. The layout of Fig. 5 shows all the detail needed for the 135 kHz side.

Now you have the narrowband i-f in a small minibox, so next in line, going backwards toward the antenna, are two 1.65 MHz stages which should go into an even smaller box, as long as there is room for a ½ in. control to set the i-f gain to your fancy. Using the two low noise rf stages and the battery-operated "ten-meter-receiver" section in front of the two i-f strips, you certainly don't need much i-f gain.

Note that these units, beginning with a 28 to 30 MHz tunable i-f, can be used on Six, Two, 432, 1296, and 2400 MHz to make up an all-VHF-UHF-S-Band receiving setup, as in Fig. 7, and that they can all operate from one battery.

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A True Tale of the Faked Fist

A ham or commercial radio operator's signature is his "fist." More than a dozen years ago when I was a Novice I worked a fellow named Ashley WA4AGT, in Valdosta GA on CW almost every afternoon. Ashley had a good fist, not perfect, but better than average. When I tuned across the 40m Novice band in search of a contact I would recognize Ashley's signal even before he finished a word or gave his call. Soon I recognized others by their fist alone, the staccato, machine-gun like Frank K4RAD, and John WA4BMG, with his dots almost as long as his dashes; and the perfectly spaced characters of Owen K4YXN. The "fist" is as much a part of an operator's being as his voice.

During World War II a trio of FBI agents used the characteristics of a man's keying hand to fool the Germans. A Dutchman named Albert Van Loop was sent to the United States to spy for the Germans and to set up a transmitter to send information back to Germany. But Van Loop, a 50 year old engineer and jeweler, defected to the United States. The FBI, however, thought it would be interesting if they kept the defection secret and set up the transmitter and sent back false information to Germany.

Van Loop, who told U.S. intelligence agents that he signed up for German spy school because he wanted to get out of Europe, showed up at the American consulate in Madrid in April 1942. He told an assistant ambassador that he had been sent by Germany to spy on U.S. troops and that he had been instructed to set up a transmitter in the U.S. and send the information back to a station in Hamburg. He had microfilm of a radio transmitter schematic, parts list, assembly instructions, a secret code plus more than $16,000 in cash. He was to buy an off the shelf receiver. The U.S. intelligence establishment, including the FBI, decided to play along.

Van Loop and his wife arrived on a Portuguese ship in New York and were immediately submitted to grueling questioning by the FBI.

From the questioning and research the FBI found that Van Loop had been a spy for the Germans during World War I and he had been convicted and spent time in jail for stealing $7,000 in Holland.

The FBI agents didn't fully trust the little Dutchman, so they allowed him to rent an apartment in New York, but under the FBI's close watch. He got a job in a jeweler's shop. The FBI set up the transmitter on Long Island and made the first contact with Hamburg on February 7, 1943.

Van Loop did not operate the transmitter; instead, it was manned by FBI men who knew German and could send and receive CW, taking the place of the Dutch counterspy.

Since this was before widespread use of magnetic tape, Van Loop recorded phonograph records of his fist and the agents played them back over and over trying to sound exactly like the counterspy. Actually it wasn't easy, for Van Loop had a very

sloppy fist and his dots were far too long, but it would have been a mistake to try and correct the faults in his sending.

A German named Vizetun could identify anyone he had ever worked on CW and American agents knew that Vizetun had listened to Van Loop sending before the Dutchman left Germany just in case someone tried to call Hamburg saying they were the real German spy when they were not.

Also, the agents had to memorize the slang or oddities of a German speaking Hollander and use them in their reports back to Germany.

Most of the information sent back was of little importance, usually true material but just trivia. One day in May 1944 word came from Washington to the agents to transmit data about troops shipping out from New York to Iceland. The agents made up stories of a drunk sailor and drunk army officer making a remark about going to Iceland. Other false leaks about Iceland were transmitted. Within 78 hours the Germans sent a photo plane over Iceland and observed dozens of tents and barracks that had recently been put up.

Actually the barracks and tents were decoys so the Germans would think the D-Day invasion would take place in Norway instead of France. The fake barracks caused the Germans to believe the Iceland base was a staging area.

Because the Germans couldn't be sure where the invasion was coming from until a few days before the battle, many troops and much equipment was held in Northern Europe and not on the beaches of Normandy.

The agents continued sending in the sloppy fist of Van Loop until April 27, 1945, when the station in Hamburg was destroyed.

Van Loop opened a jewelry store in a large Eastern city after the war and became a citizen of the United States. If you have ever worked an old Dutchman with dots twice as long as they should be, he might have been the hero of Normandy who spent the day of battle in his New York apartment while special agents sent false information to the enemy using Van Loop's fist.

. . . W4ZBE

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Adapting Telephone Handsets to FM Transceivers

Many hams are enjoying the benefits of using a telephone type handset in conjunction with their two meter FM equipment. There are several advantages to this type of microphone arrangement. The shape of the handset almost assures proper microphone technique; the earpiece frequently improves the readability of incoming signals by reducing the apparent amount of road noise; and the listener gains a bit of privacy, if desired, by not using the speaker in the set simultaneously.

At the top end of the spectrum are commercial handset assemblies such as the Shure model TH-100. It includes switching to mute the speaker in the set when the handset is in use, and is designed principally to be wired directly into the set, rather than to adapt to an existing microphone connector. At a lower cost, the ham can convert a handset designed for another purpose for use on an FM transceiver. Frequently surplus outlets offer handsets, usually manufactured by Stromberg-Carlson, which include a carbon microphone, a high impedance earphone, and a quality push-to-talk switch. Alternately, a small pushbutton can be installed near the earpiece end of a conventional handset from a telephone set in order to provide for PTT operation.

In order to adapt a handset using a carbon microphone to most modern two meter FM transceivers it is necessary to change the microphone element and the coil cord. If your transceiver uses a low impedance microphone such as a Drake TR-22, the replacement cartridge for a Shure type 514B hand microphone is an excellent choice. While not the least expensive element, it delivers high output with superb audio quality, and readily fits in place of the original carbon type by simply wedging it from behind with a small pad of foam rubber. For sets like the Clegg or Regency which use a high impedance microphone, the replacement cartridge for a Turner model 360 hand microphone provides good audio quality and also is a snug fit in most handsets. The coil cord may be replaced with a Belden No. 8497 coil cord. This is necessary because the original cord does not have a shielded conductor which is required because of the low level of non-carbon microphones.

Most two meter transceivers employ a three circuit microphone connector. Since a ground, a switching lead, and a microphone audio lead are required for a conventional

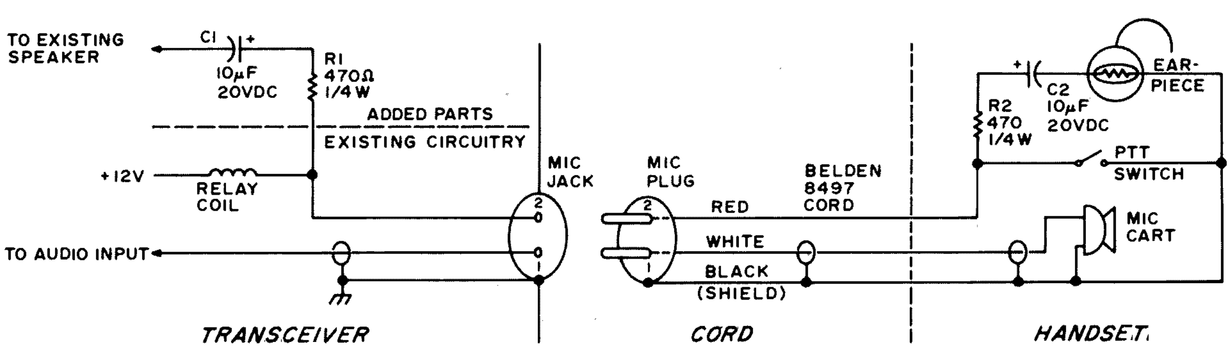

Fig. 1. Handset connection.

microphone, there is no conductor left to bring the receiver audio up to the earpiece. To avoid defacing a truly fine radio such as a Clegg FM-27B (mine in this case), an alternate solution to changing the type of microphone fitting was needed.

A little thought yielded an easy solution to the problem; simply superimpose the receiver audio on the push-to-talk conductor in the coil cord. This is a workable solution since the relay coil looks like a fairly large inductor at audio frequencies, and therefore will not short out the receiver audio. Conveniently, the PTT switch will short out the line to the earpiece, fully muting the receiver audio in the transmit mode. This is a nice plus, as some transceivers do not fully deactivate the receive audio in the transmit mode, resulting in a faint but annoying sound in the earpiece while transmitting.

A glance at Fig. 1 will show how it all goes together. The values of R1 and R2 were used successfully with both a Clegg FM-27B and a Regency HR-2A; however, they may be reduced to provide more audio to the earpiece, or increased to provide less should a different balance between speaker and earpiece volume be desired. Most handset earpieces have a small beadlike device across the terminals. This is a varistor whose function is to level out variations in signal input. It is recommended that this be left in the circuit as it really does help.

A note of caution to anyone planning to disconnect the internal speaker in the set is in order. If you do remove the speaker, or install a switch to defeat it at will, be certain to substitute a resistor such as 10 Ohms at one or two Watts in place of it. This is important because failure to do this may result in reverse polarity appearing across C1 with certain types of transceivers. This is not good for electrolytics.

Several of the local hams have added the convenience of handset operation to their sets using the methods outlined here. All are reporting fine results. Naturally, the original microphone may be carried as a spare; its operation is of course not affected by the addition of the circuitry for the handset audio. See you on 88 or 61 or 94 or. . .

. . .WA8LEM

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Atlanta 1975

The Atlanta Hamfest was a perfect way for the family to spend the Fourth of July holiday weekend, and the Atlanta Radio Club did a fine job of planning.

For the ham, there were many manufacturer and dealer exhibits, as well as a sheltered flea market. Fifteen forums and meetings were well attended, especially the ARRL and FCC ones. XYLs and YLs had a special hospitality suite — not to mention bus tours of Atlanta and vicinity. There was even a well equipped nursery for young harmonics.

Eighty persons took advantage of the special opportunity offered by the FCC to take a license exam on Saturday morning. Mr. Ditty, Atlanta District Engineer-in-Charge, and several other employees gave up their day off just to administer the exams! Who said the FCC has no heart?

Saturday night, Prose Walker was the featured speaker at the banquet, where he spoke to a "full house" of 300 persons on Docket 20282. Among his comments at the banquet and at the FCC forum the next day, Walker stated that restructuring is necessary to increase the number of licensed amateurs in the United States. Less than 275,000 amateurs occupy 13% of the spectrum between 3 and 30 MHz, and this number is decreasing monthly. "The future of amateur radio demands that our ranks be increased," he asserted. "The average age of an amateur today is 43 years old."

The "Communicator" or "Basic Amateur" license class is inevitable. The unanswered question is, "How do we accelerate him into the mainstream of Amateur Radio?" Walker said that this must be done by education and training, in ham clubs and on the air. The FCC has no magic formula for best restructuring ham radio. They are reading the 2000 comments filed to date, trying to find the right direction, and claim the results of the ARRL membership poll should be of assistance.

The only thing I did not quite follow was the comparison of hams and CBers: Amateur radio is clearly defined in Part 97, while the purpose of CB radio is defined in Part 95. A ham is permitted to radiate a signal with 2000 Watts PEP with the intent of being

Display booth bedlam.

Dick Ehrhorne presents Alpha 374 2 kW linear to K4IOQ.

heard anywhere in the world. A CBer, in contrast, transmits a 5 Watt (12 Watt PEP) signal for the purpose of short range (less than 150 mile) communications. How can these two very different services be compared only in terms of number of licenses of transmitters?

Another area covered was plans for the upcoming WARC '79; Walker received a standing ovation for his speech.

It is interesting that the only equipment reported stolen at the Hamfest was a walkie-talkie from a booth. No automobile or room burglaries were reported. Could it be that people in the southeast practice the golden rule?

Eight thousand dollars worth of prizes were given away, with K4IOQ the proud winner of the first prize, an Alpha 374 2 kW linear amplifier.

Sales were generally slow. Most exhibitors felt they had excellent exposure and most recovered their costs. Could be that southeastern hams are saving up for a rainy day.

Everyone did agree that the 1975 Atlanta Hamfest was well planned and coordinated, and we're looking forward to next year.

...W6LJU

Prose Walker at the podium.

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ATV on 450 with a T44

TV is presently enjoying a never before realized popularity. Much of the rf equipment now utilized for ATV has been 450 UHF commercial FM equipment with video modulators added.

The most popular of the present modified mobile equipment are the Motorola T44, the GE Prog line and the RCA Carphone. Each of these rigs possesses certain advantages and disadvantages. All of them do have the significant disadvantage of requiring relatively heavy, complex power supplies and consuming relatively large quantities of power.

In an effort to reduce the cast iron content of my shack along with a reduction in power consumption, I decided to utilize already existent solid state equipment to simplify my TV system.

The first ingredient in the project was a newly purchased SB-450 transceiver. The second item was the dead T44 transmitter strip from the junk box. Last, a W∅MZL video modulator was added to the stack. A liberal application of miscellaneous parts from the hidden recesses of the work shop yielded one hybrid (1 tube) television transmitter.

The total power drain was 90 W for a 30 W rf output! (Contrasted with more than 250 Watts for a T44 under similar conditions.)

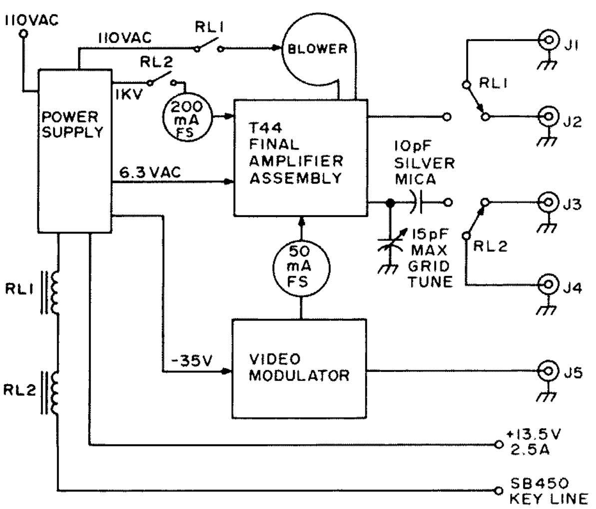

Fig. 1. System block diagram.

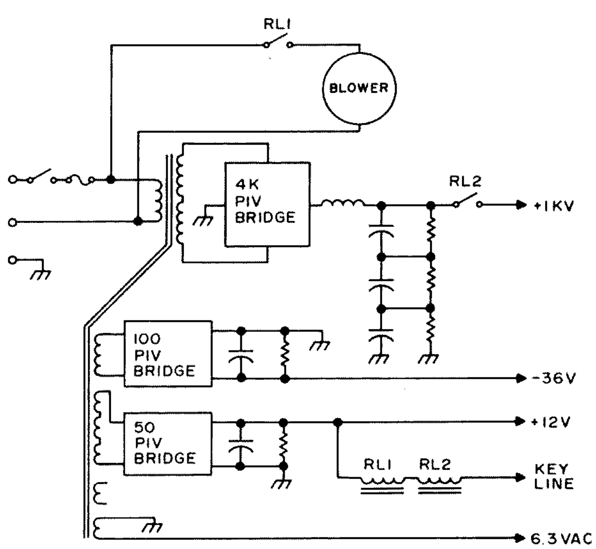

Fig. 2. Typical power supply.

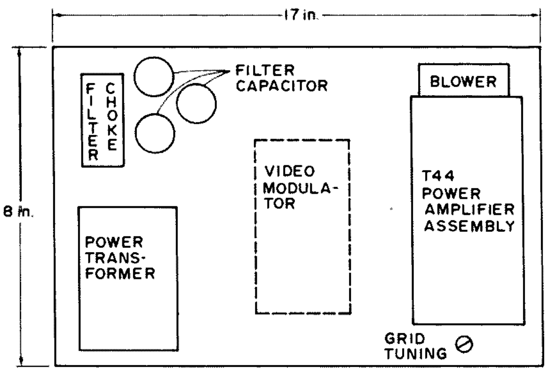

Fig. 3. Chassis layout.

Fig. 1 shows the block diagram of the hybrid transmitter. The power supply is left to your own devices. Fig. 2 shows the one that I used. A minimum of 800 V dc at 150 mA (max of 1 kV) is recommended for the high voltage. Relays RL1 and RL2 were salvaged from Motorola T44s also.

The layout of Fig. 3 is one of many possible arrangements. This particular arrangement divides the chassis into three nearly equal sections – power supply, video and rf – and is convenient.

Tune up of the amplifier is simple with only one possible hitch. The SB-450 possesses an swr protection circuit which turns off the transmitter. In order to reset the protection circuit, the SB-450 power switch must be turned off and then returned to the on position.

With this in mind it is important to preset the grid tuning capacitor to approximately ½ mesh. If the transceiver trips, reset and rotate the capacitor one way slightly and try again.

Final adjustment of the grid tuning will be made after the plate tuning and loading are accomplished. The following procedure should be used in setting up the amplifier. Remove the top cover from the amplifier cavity.

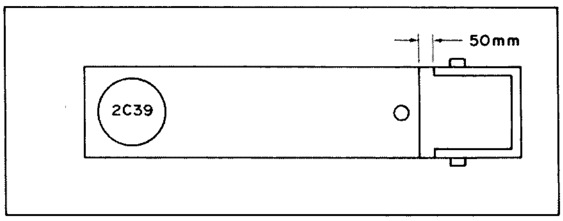

Fig. 4. Cavity amplifier — Interior.

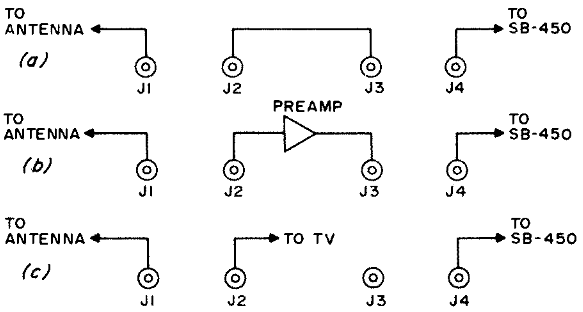

Fig. 5. Possible interconnection diagram.

The physical layout of the interior is shown in Fig. 4. Set the length of the line plate to the dimension shown. (50mm for 440 MHz.)

Apply drive to amplifier, and adjust plate tuning for a dip. The plate tuning control is the large screw-driven adjustment on top of the cavity. Then adjust the loading control using a non-metallic screwdriver for maximum power output, taking care not to exceed 100 mA average plate current. Grid bias should be about -25 V and power output should be about 35 W. Detailed tune-up procedure for video operation can be found in the December 1972 issue of QST.

The amplifier can be used for TV, FM and AM if desired. If desired for use only as an FM amplifier, the video modulator may be eliminated. For AM operation an external modulator may be used or the video modulator may be used simply by providing 1 V peak to peak audio to the input of the video modulator.

Several options are available for receiving. By placing a jumper between J2 and J3, the SB-450 can be used to monitor the TV simplex channel directly. If a preamp is necessary, it could be placed between J2 and J3. Alternatively, the Ham TV receiver could be connected directly to J2.

Other combinations to suit specified needs could certainly be devised. Fig. 5 shows possible interconnections.

The hybrid approach to a TV transmitter proved to be simple to construct and required a minimum of construction effort. This technique could be applied to other commercial and military equipments as well – in particular, GE Prog line and the AM-1178 military UHF amplifiers.

. . . KØMOC/WA4EMO

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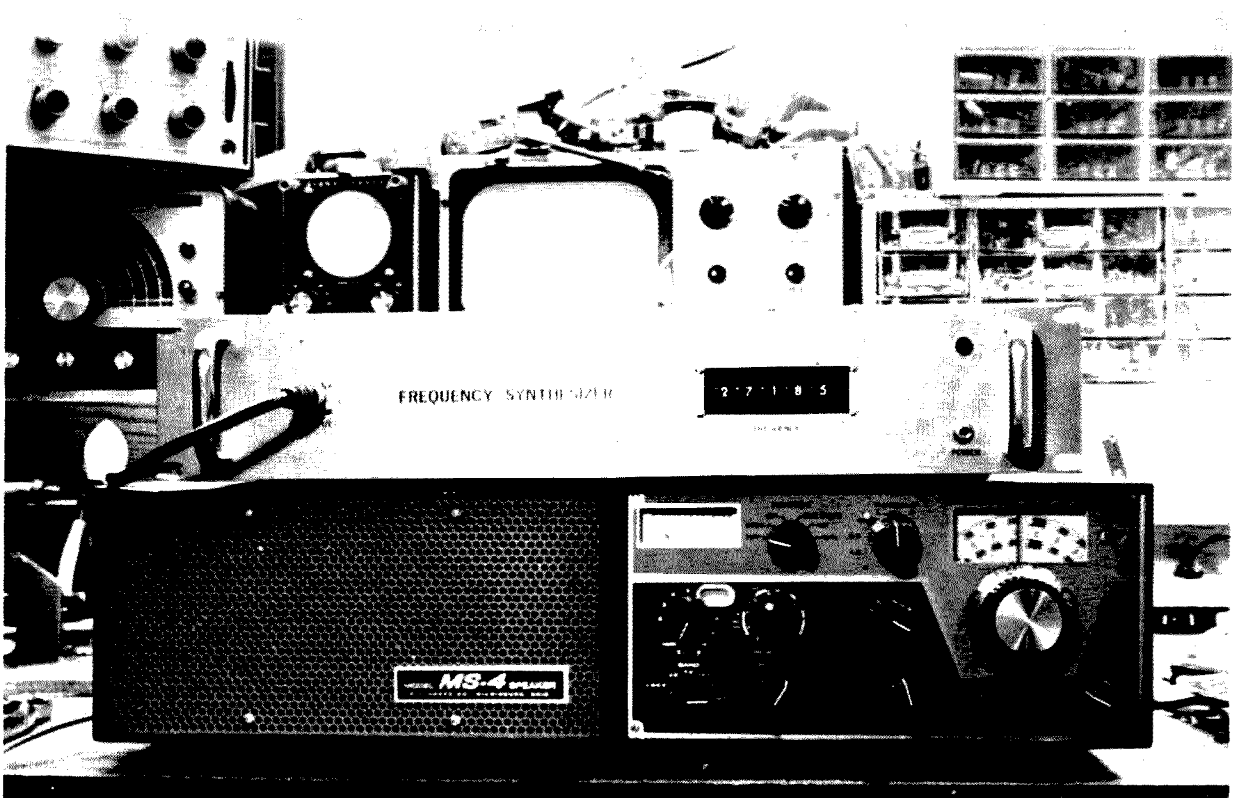
0-60 MHz Synthesizer

Part One

The design of a stable yet versatile frequency source has long been a central problem of amateur radio. And while great progress has been made over the years, VFOs still drift, and crystals still cost upwards of $5. Operation in VHF and UHF is still largely crystal controlled.

The ideal solution to the problem is the frequency synthesizer, which combines the versatility of the VFO with the stability of a crystal. Suitable synthesizers, such as the Hewlett-Packard HP-5100B, have been around for a long time, but a price tag of around $10,000 put them far beyond reach of the amateur.

However, the introduction over the past 2 years of a whole line of ICs specifically designed for phase locked loop (PLL) fre-



Front view.

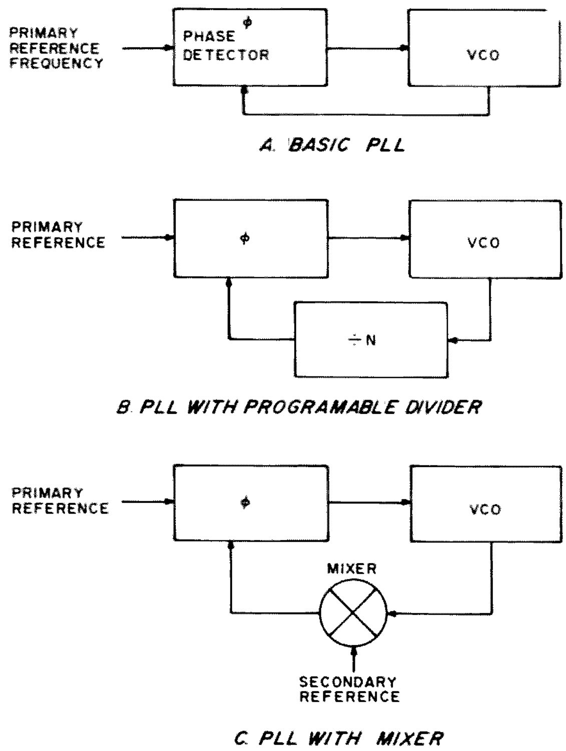


Fig. 1.

quency synthesizers has completely changed the picture. By using these ICs and the circuitry described in this article it is now possible for the amateur to build a frequency synthesizer offering 1 kHz (0.1 Hz optional) resolution to 60 MHz, along with excellent spectral purity, for around $300.

A Word About Synthesizers in General

The frequency synthesizer described in this article works on the phase locked loop principle recently made famous by such ICs as the Signetics 565. There are, however, several other types of frequency synthesizers, and before going on I would like to briefly mention two of them.

The oldest principle, and the one on which the venerable HP-5100B is based, generates the desired frequency by performing arithmetic operations (addition, subtraction, multiplication, division) on a set of crystal-controlled primary standard frequencies. This method requires a large number of primary standards (20 or more), a highly complex system of mixers, multipliers, dividers, and filters – plus a sophisticated control section. It works very well, and can switch between channels extremely fast, but it is too involved and expensive to be worthwhile to the amateur.

Another principle in use today is that of direct digital synthesis. In this method some sort of digital counter is used to drive a ROM (Read-Only-Memory) which in turn drives a DAC (Digital-to-Analog Converter), which generates a sine wave (or other desired signal). This method is capable of high resolution and fast switching time, but the maximum frequency obtainable is limited by the ROM to 1 MHz.

This leaves the phase locked loop. In this method, Fig. 1(a), the output of a voltage-controlled oscillator (VCO) is compared to a reference frequency, and a correction voltage applied to the VCO to keep it precisely in phase with the reference frequency. The loop may be opened, as shown in Fig. 1(b), and a divider inserted, so that the VCO is locked to the n_{th} harmonic of the reference; or, as in Fig. 1(c), a mixer can be inserted, so that the VCO is locked to the secondary reference frequency plus or minus the primary reference.

When used with a programmable divider the resolution (minimum frequency difference between adjacent channels) of the PLL is the same as the reference frequency. When a mixer is used the VCO frequency is entirely determined by the two reference frequencies and the question of resolution doesn't arise.

Now we come to the basic disadvantage of the PLL. Because the signals involved are almost invariably digital, correction voltages can be generated no faster than once each cycle of the reference frequency. As a result, the loop can respond to changes, either external programming changes or internally generated noise, no faster than about one tenth the reference frequency. Here then is the problem; in order to achieve high resolution a low reference frequency must be used, while in order to achieve fast response time and a clean signal a high reference frequency must be used. Therefore high resolution and low noise are mutually exclusive goals for a single PLL, and we reach an impasse.

The way around it is to use several PLLs together.

A Practical Multi-PLL Design

The block diagram of the synthesizer is

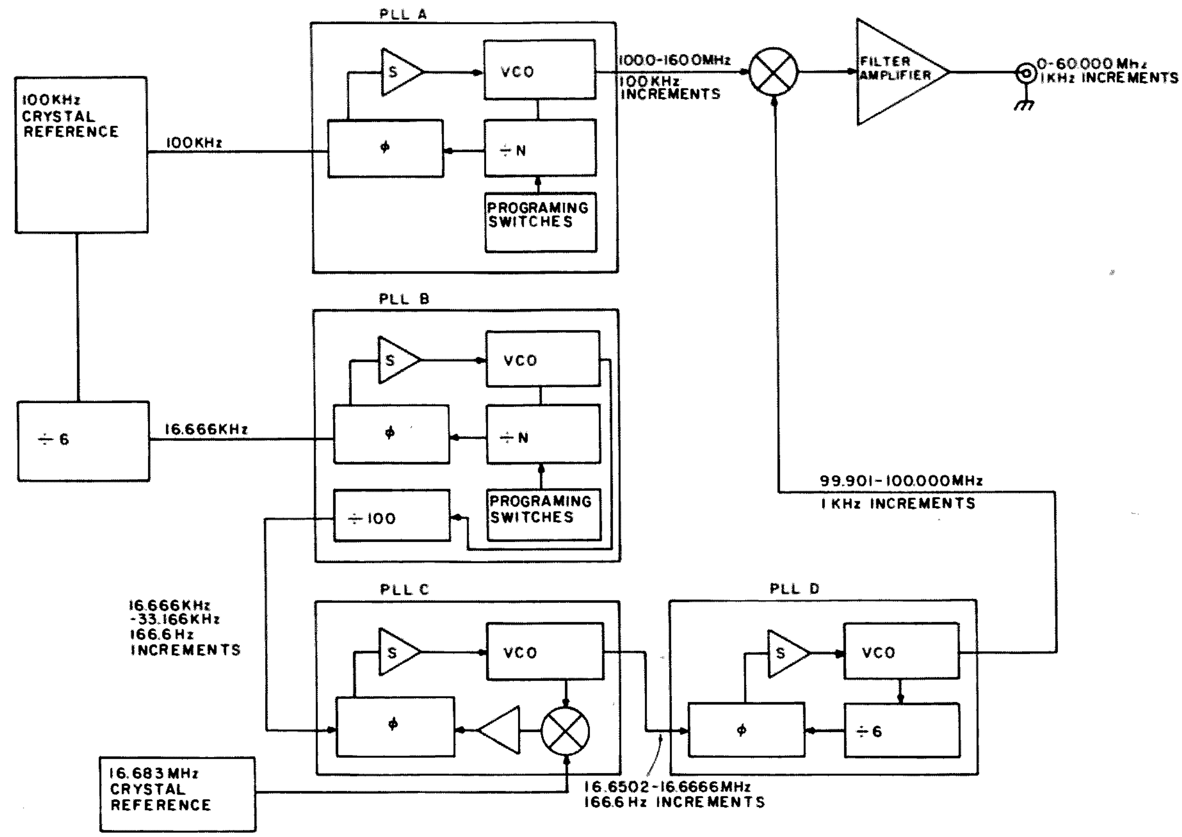


Fig. 2. Frequency Synthesizer.

shown in Fig. 2. It consists of four PLLs connected together.

The operation of PLLs A & B is straightforward. PLL A is programmed by the front panel programming switches to produce any multiple of the 100 kHz crystal reference between 100.0 MHz and 160.0 MHz. PLL B, also programmed by the front panel programming switches, produces any multiple of 16 2/3 kHz between 1666 2/3 kHz and 3316 2/3 kHz.

The output of PLL B is then divided by 100 to produce 16.666-33.166 kHz in 166.6 Hz increments. This is fed into the primary reference input of mixing PLL C.

Instead of dividing the output of its VCO with a programmable divider, PLL C mixes the VCO output with a secondary crystal reference frequency and obtains the difference frequency. The difference frequency is then compared to the output of PLL B and a correction voltage generated to keep them in phase. The net result of this process is to subtract the output of PLL B from the 16.683 MHz secondary reference, giving 16.6502-16.6666 MHz in 166.6 Hz increments.

The output of PLL C is fed into PLL D, which simply multiplies it by six, thus producing 99.901-100.000 MHz in 1 kHz increments.

The output of PLL B is then subtracted from the output of PLL A, giving a final output of 0-60 MHz in 1 kHz increments.

The synthesizer is much more complex than a single PLL, but this is justified by major improvements in performance in three key areas.

The response time of a single PLL with 1 kHz resolution would be around 100 ms; the response time of the synthesizer is around 2 ms.

Noise, both sideband and white, in a PLL with 1 kHz resolution would be totally unacceptable. Noise in the synthesizer originates primarily in PLL A and PLL C. However, PLL A operates at a reference frequency of 100 kHz, which is high enough to get rid of all audible noise, and PLL C uses a special crystal controlled VCO which generates virtually no noise to begin with. The result is that noise is kept 80 dB down.

Finally, the resolution of the synthesizer can be extended to 10 Hz, or even 0.1 Hz,

with no increase in response time or noise. This is done by adding some more PLLs between PLL B and PLL C, as shown in Fig. 3.

The thing which more than anything else made the construction of the synthesizer possible was the introduction by Motorola of the PLL building blocks, especially the 4016 programmable divider, the 12012 prescaler, and the 4044 phase detector. These ICs compressed whole circuit boards into a few DIPs so easy to use that the actual circuit looks like a block diagram. This external simplicity combined with internal complexity can make their operation seem mysterious, so before going on I will give a very brief description of them. Complete descriptions are given in the Motorola data sheets listed at the end of Part Two.

Programmable Dividers

The Motorola set of programmable dividers consists of the 4016 presettable down counter, the 12012 variable modulus prescaler, and the 12014 control logic.

The 4016 counters are down counters with internal zero detection and a program enable input. In operation they count downward from whatever they are preset to until they reach zero, when they reset themselves

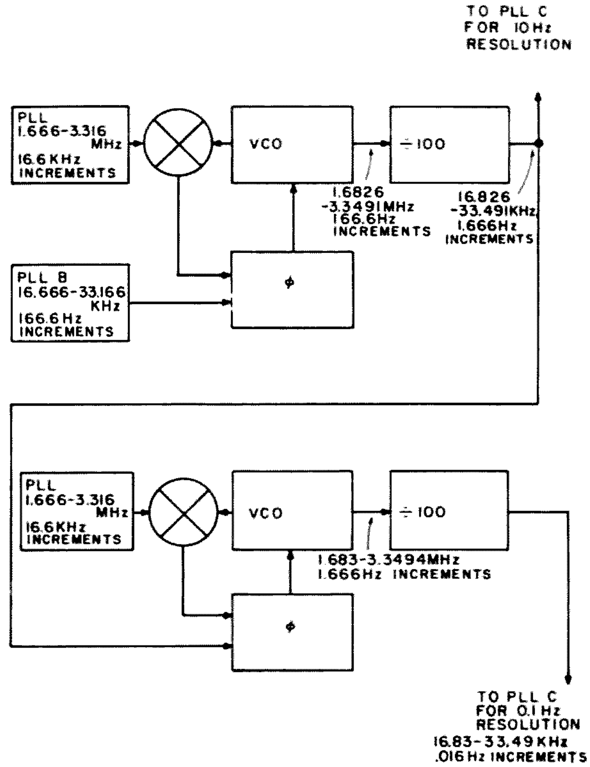


Fig. 3. Extending resolution of synthesizer.

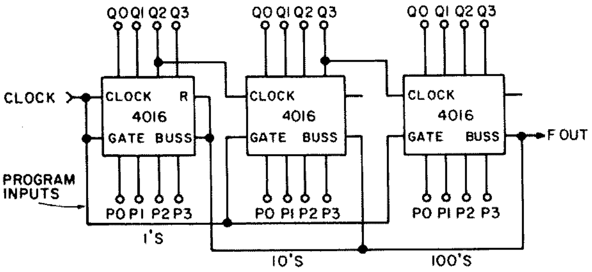


Fig. 4. Three decade programmable counter.

and start counting down again. Any number may be connected in series as shown in Fig. 4. The programming pulse is obtained by wired-oring the open collector zero detect outputs of all counters, and is equal in length to the period of the clock signal less the propagation delay of the clock through the counter. As the clock frequency goes up the length of the programming pulse quickly approaches zero, thus limiting the maximum operating frequency to 8 MHz.

To get around this problem and extend the operating frequency to 25 MHz you can use the early decode function of the 12014 control logic IC. This function detects when the 4016 counters reach the count . . .02, and then programs them with a pulse one whole clock period wide, counting the remaining 2 counts itself and then enabling the counters again.

However, 25 MHz is still far below the 160 MHz required by the synthesizer. It is possible to simply divide the output of the VCO by 10, and then use the 4016s, but in order to maintain resolution the reference must also be scaled down by 10, thus greatly increasing noise and response time.

The solution is to use a method called variable modulus prescaling. This method employs a high frequency prescaler capable of being programmed to divide by 2 numbers, usually 10 and 11. The number by which you wish to divide the clock frequency, call it X, is then separated into two components: the least significant digit, L, and the rest of the number, M. Thus, X = 10(M-L)+11(L). For example, if X=387, then L=7 and M=38.

The prescaler is then set up so that it divides the clock by 11 L times, and by 10 (M-L) times before starting over. Take 387 again; L=7, M=38. The prescaler counts to 11 and resets (in other words, divides by 11)

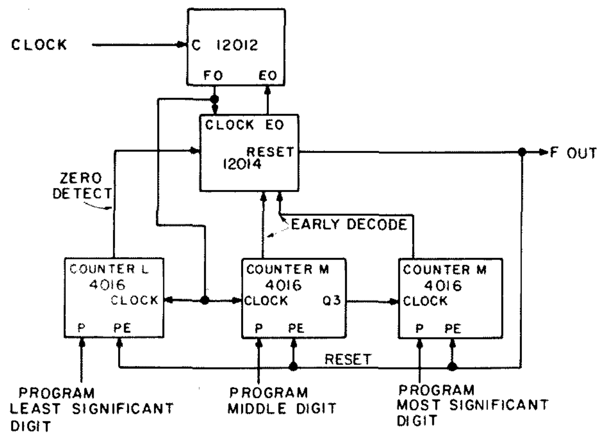


Fig. 5. Block diagram of variable modulus programmable counter.

7 times, a total of 77 counts. It then is reprogrammed to divide by 10, and counts 10 clock cycles M-L, or 38-7= 31 times, for a total of 310 counts. It now reprograms to divide by 11 and starts over, having counted exactly 387 counts, which is another way of saying that it has divided the clock frequency by 387.

This is precisely the way the Motorola 12012 high frequency variable modulus prescaler works. Programming is accomplished by holding the EO input low for divide by 11 and high for divide by 10. In combination with the 12014 control logic and some 4016 counters it forms a complete high frequency programmable counter capable of operating up to 200 MHz. A block diagram of a typical circuit is shown in Fig. 5.

The least significant digit of X is programmed into Counter L, while the remaining digits, M, are programmed into counter M. Let's take 387 again. Counter L is programmed to 7 and counter M to 38. The counter control logic senses that Counter L is not at zero, and programs the prescaler to divide by 11. Every time it counts 11 clock pulses it produces a single pulse which counts both the L and M counters down by one. When the L counter reaches zero, the control logic reprograms the prescaler to divide by 10. The prescaler now produces a single pulse for every 10 clock pulses, and the M counter, now down to M-L, or 31, continues to count down. When it reaches . . .02 the control logic as described earlier resets both counters, and the process begins again. The counters are reset once every 11L+10 (M-L), or X pulses, and thus

the reset, or program line has a frequency equal to the clock divided by X.

This method has the advantage of dividing the clock by 10 or 11 so that the relatively slow 4016s can deal with it without the decrease in resolution that accompanies fixed ÷10 prescaling. There are, however, some restrictions on the value of X. It must be possible to represent it as the sum of integral multiples of 10 and 11. This includes 10, 11, 20, 21, 22, 30, 31, 32, 33, ...99, and all integers above 100. Obviously this method is restricted to applications where X is larger than 100. In the synthesizer described here the minimum X is 1000, so this is no problem.

The 12012 prescaler is an ECL device, as indeed it has to be to operate at 200 MHz. However, in order to make it easier to use it contains on chip ECL–TTL and TTL–ECL translators on the FO output and EO input, which explains the apparent abandon with which it is connected to the TTL control logic. The clock input remains standard ECL 10k, and is best driven from an ECL line receiver such as the 10216.

Phase Detector

The 4044 phase detector consists of a digital phase detector and a charge pump. When used with an integrator it forms a near ideal PLL building block. The logic of the phase detector is quite complex, and, as a full description is given in the data sheet, I will give only a brief functional description here.

The phase detector has two inputs and two outputs. It accepts the reference fre-

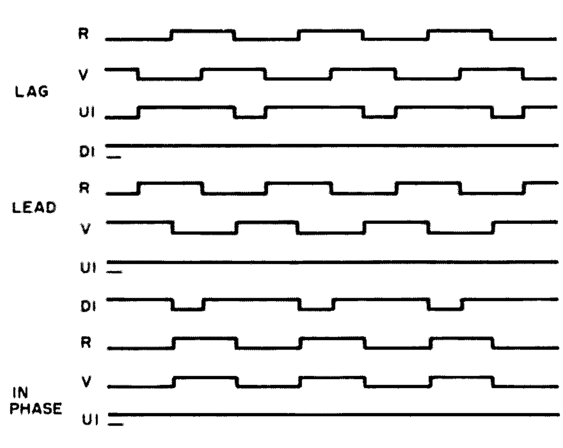


Fig. 6. Waveforms of 4044 phase detector.

quency at one input, and the output of the programmable divider, mixer, or VCO at the other input. It is sensitive only to the downward transitions of the inputs, so duty cycle is unimportant.

If the downward transitions of both inputs occur together, that is, if they are in phase, both outputs remain high. If one input lags behind the other, a pulse appears at the appropriate output, as shown in Fig. 6. The phase detector also prevents harmonic lockup. The outputs of the phase detector are fed into the charge pump, which consists of an inverter and a couple of diodes. The charge pump is connected to an integrator, and the output of the integrator is connected to the VCO, thus closing the loop. See Fig. 7.

Operation is as follows. If the VCO and reference are in phase, no pulses appear at the output of the phase detector, the charge pump neither pushes nor pulls current out of the integrator, and consequently there is no change in the output of the integrator or in VCO frequency. If the two are not in phase one of the outputs of the phase detector pulses, the charge pump pulls or pushes current out of or into the integrator, and the control voltage moves up or down to correct the error.

This system has the advantage that when in lock the only ripple appearing in the control voltage – which causes FM of the VCO, or sidebands – is the result of leakage in the integrator and charge pump, and these can be made very small.

The response characteristics of the loop are determined by the components used in the integrator. The values of these components are a compromise between low sideband-causing ripple and fast response time, and are rather critical. A full explanation of the equations used is given in the 4044 data sheet, so I will give only a highly

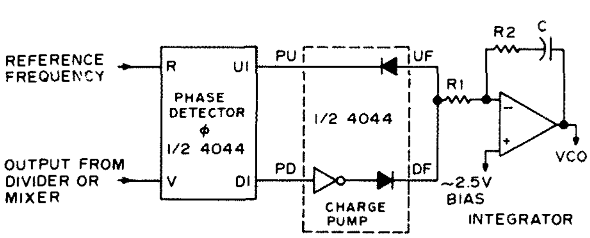


Fig. 7. 4044 phase detector.

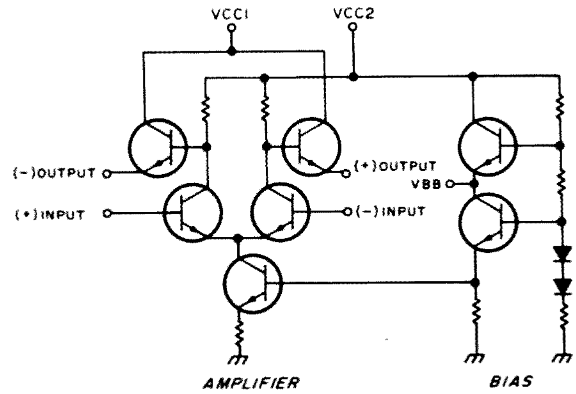


Fig. 8. 10216 amplifier.

abbreviated form below.

$$C = \frac{K}{N\,(F_{ref})^2 \cdot 25}$$

where

$$K = \frac{F^{VCO}_{MAX} - F^{VCO}_{MIN}}{V^{VCO}_{MAX} - V^{VCO}_{MIN}} \cdot 2\pi$$

$$N = \frac{F^{VCO}_{MAX}}{F_{ref}}$$

$$R_1 = 1\text{ k}$$

$$R_2 \approx \frac{40}{F_{ref} \cdot C}$$

Line Receiver

The last IC I shall mention was not specifically designed for PLL applications, but it is nevertheless extremely useful. It is the 10216 MECL 10k triple line receiver. It contains three differential amplifiers, one of which is shown in Fig. 8. These amplifiers have a gain of 16 dB and are useful to well beyond 200 MHz. They are capable of ½ volt single ended output into 50Ω, and are of course compatible with ECL logic levels. They work well as buffers, amplifiers, and oscillators. Two rules should be observed. First, the gain from an input to the inverted output is much higher than that to the non-inverting output, so unless you need differential inputs and outputs, always use the inverting output. Second, always tie one input of an unused amplifier to VCC or VBB in order to maintain proper operation of the bias network.

Next month: Circuitry and design guidelines.
...CALVIN

Dan Davis K3DSQ/4
1700B Ninth Street
Langley AFB VA 23665

Bridging the Information Gap

A recent QST article[1] pointed out how one amateur group identified the need for and then constructed a public relations program, largely by taking advantage of available resources. While the author describes a sound and effective approach to solving a problem, he touches on only one aspect of a profession which has been given the generic title of "public relations," and one which holds important ramifications for amateur radio.

There is much more to the process than trying to keep the general public informed of our activities, and in an age when amateur radio is rapidly undergoing an identity crisis of its own, it is to the advantage of ham radio clubs at all levels to think in terms of a total information program.

Unfortunately, the term "public relations" is overworked, negative in its connotation, and erroneous in its application. Replace the concept of a smooth-talking, glad-handing PR man with that of a well-organized director of information who is concerned with three broad program elements: public information, internal information, and community relations. While these three elements are designed to meet different objectives and it is frequently hard to determine where one ends and another begins, they all eventually come together to produce some rather effective results.

Internal Information

For years amateur radio groups have worried and fretted about getting their story told to the general public. This is important and admirable, but in the rush to make certain that the local community knows all about the preparations for Field Day or how the local repeater club can serve the city rescue squad, we all too frequently overlook the information needs of amateurs themselves.

It shouldn't come as too much of a surprise to learn that not all hams are League members nor even belong to the local radio group. These individuals have a right to know what's going on in the amateur community and how it affects them, and there is probably no better way of getting the word out to everyone than through a newsletter or club newspaper.

Any internal publication should probably include at least three major sections:

1) a general section which includes news of wide relevance (meeting schedules, awards, hamfests, impending elections, etc.);

2) a special division which dwells on such specialized facets of amateur radio as repeater operations, VHF/UHF operating, and contests; and

3) a classified section in which hams can list items for sale or their individual needs. This last element might be expanded to include projects being worked on by club members. And, the classified section might be of some interest to electronic stores in the area who could be "talked into" spending a few dollars to advertise therein and thus provide the club with added revenue and a means to defray the cost of publishing the paper.

Your distribution list for the newsletter should probably include other organized amateur groups throughout the state on a reciprocal basis. It's always nice to know

[1] Keith, Don, "Getting the Story Told!", *QST*, October, 1974, pp. 49-51.

what other clubs are doing, and many local problems can be solved from a lateral cross-feed of information.

From an internal standpoint, it's generally a good practice to know the names, calls, and addresses of all hams living and operating in your "sphere of influence." Why not purchase a copy of the Amateur Callbook at least twice a year and delegate someone to pore through the listings for your call area and compile a list of the local stations. Periodically you might send non-members a copy of the club newsletter, possibly generating enough interest on their part to drop by and attend a meeting.

Public Information

No matter how you view this function, perhaps the most important rule here is that in dealing with the local print and broadcast media you want to present your news story or feature in such a manner so as to not turn them off. In other words, don't make mountains out of molehills by exaggerating the importance of the story. You fool no one, least of all a harried city editor or news director who is already overworked.

The basic objective of the public information element is informing the local community – laymen – about a particular facet of your amateur radio operation that is or should be of some interest or relevance to them. I don't think the public audience is too interested in knowing the results of your routine meetings or who participated in the last VHF Party. But there may be an angle in the composition of your group (the butcher, the baker, the candlestick maker, who are all hams) or how the new two-meter repeater will benefit the community or how the club's TVI committee responds to complaints. Be honest with yourself in your appraisal of a story's news value.

If I had to recommend one step to take before doing anything else, it is to develop contacts at each newspaper, TV, and radio outlet in the community. In the case of the newspaper it's the city editor or science editor while at the broadcast media you'll want to know the news director. Introduce yourself, present a copy of your club's fact sheet, tell him you'll be contacting him periodically with stories, and ask what you can do in preparing a story that will help in getting it published or put on the air. Don't become pushy or develop the attitude that you have a right to get publicity. Like every other special interest group in the area, you're competing for a piece of the pie and just how big that piece will be depends largely on how realistically you define your objectives, and the expertise you use in trying to accomplish them. You can succeed, but in addition to practicing the ABCs of basic journalism (accuracy, brevity and clarity) add honesty and tact.

Public information encompasses more than preparing a news release as the result of something happening or scheduled to happen; it should be continuing without being obtrusive. Information kits placed in strategic locations can accomplish this. A kit should include a fact sheet (a resume of the club's history and objectives), copies of recent articles concerning the club, an up-to-date list of officers, information about repeaters, and anything else that might be of interest to the non-amateur reader. Place copies of the kit with the local chamber of commerce and at information centers throughout the area.

As a final note about the public information aspect, I recommend strongly that if your group includes a member who has any experience at all in working with the media ask him to handle this task or go all the way and appoint him your director of information. His qualifications make him a natural for the job, and if he has any interest at all in amateur radio he'll find some way to accommodate the group's program in his schedule of activities.

Community Relations

The community relations element probably comes closest to the stereotype of the old PR concept, for the objective here is primarily one of fostering within the community an atmosphere friendly to the conduct of amateur radio operations. And after this atmosphere is established, we probably should want to capitalize on it by going one step further: proselytizing to seek new amateurs.

A comm rel project is generally designed to let the public know what we're up to in general and how this affects the community.

In this sense, comm rel approaches the public information function, except that the goal is not only to inform but to deliberately try to influence attitudes as well.

Three types of activities come to mind and ought to be included in your club's repertoire: a speaker's program, an open house, and participation in selected community-wide projects.

Service organizations (Kiwanis Club, Rotary International, Lion's Club, etc), church groups, Boy and Girl Scout meetings, high school science clubs, and women's clubs all need speakers; it isn't too presumptuous to think that each might be interested in hearing an informative presentation on amateur radio.

A club member who can speak in public, a well-written script, a 35mm slide projector, and possibly a tape recorder can be assembled to form a briefing that can highlight virtually any kind of club gathering.

Plan the briefing well, organizing in rhetorical fashion the major points you're going to cover by means of an introduction, a body, and a conclusion. Once you've introduced the topic by showing its relevance to the audience, you'll probably be speaking about two major points: amateur radio in general (what it is and a brief history) and how your club fits into the overall picture. At the end you'll summarize and point out that your club can provide more information to interested persons. This is only a very skeletal approach to developing a good briefing; there are others, but remember that the important thing is to organize the script logically and coherently.

Rather than attempt to bring an entire station to the scene of the speaking engagement (where "gremlins" invariably appear and destroy whatever measure of realism and authenticity you hope to achieve), capture on magnetic tape off-the-air QSOs as examples to work into your briefing. And while you're at it, you might as well take the extra step and shoot 35mm slides to accompany the entire briefing, including summaries of your important points (lettering kits are fairly inexpensive and easy to use) and plenty of shots of *people* operating equipment, erecting antennas, etc.

Plan for about a twenty-minute presenta-

tion and allow approximately ten minutes for answering questions. And, make certain that the speaker is an individual who is both knowledgeable about his topic and capable of speaking before an audience.

Besides an active speaker's program, the radio club can open its doors to the community once a year, assuming, of course, that the group has available a building or room where equipment can be set up and which can accommodate a large number of visitors.

Are civic exhibitions held in the community periodically? If so, then seek permission to set up exhibits – attractive booths which graphically depict the role of amateur radio in the community. Use photographs and charts as visual aids.

And finally, from time to time various groups within the area sponsor projects in which amateur radio can make important contributions. Watch for such things as Leukemia Walkathons, parades, and other projects where FM repeaters can provide needed communications links. Volunteer your services – don't wait to be asked.

In summary, every amateur group, no matter how small, can only benefit from a systematic and organized information program. With our decreasing numbers and an ever-growing public service and CB group (with their associated manufacturers' lobbies), amateurs can no longer afford to rely solely on "PR" as a means of bridging the information gap.

Now, perhaps more than ever, we need to insure that amateur radio is known by as many people as possible for what it is, not necessarily to compete with citizens band and other public service operations *per se* but rather to make certain that our interests are protected. In order to do this, we need to have a friendly environment in which to operate as well as an informed community of fellow hams and laymen alike. "PR," as anachronistic as the butch haircut and the liquid-fuel rocket, no longer meets the demands of an information-oriented society. The triangular total information program, however, is geared to meet these demands, and while the development and implementation of such a program is going to require a certain amount of effort, dedication, and even money, the results will certainly justify the expenditure.

Several Considerations for an Information Program

1) Appoint as director of information an individual who wants to succeed. While a background in advertising or journalism may certainly be helpful, it's more important that the director be well-motivated.

2) At the beginning of the year, compile a list of your information program objectives. Know what you want to do, why you need to do it, and how you'll go about doing it.

3) Meet personally with editors and news directors. Also include on your visit list the director of information for the local chamber of commerce.

4) Allow only one spokesman for your club; the group must speak with only one voice to preclude embarrassing contradictions.

5) A written story is usually more valuable to a newsman than a verbal description. The reporter can always rewrite the article, and he'll contact you if he needs more information.

6) Spend some money for a typewriter and letterhead stationery. If the club budget allows you to really splurge, invest in a decent camera and some photo supplies.

7) Publish a club newsletter on a periodic basis, sending copies to other clubs in the state and to non-members as well.

8) Develop an informative briefing about amateur radio and your club (preferably a 35mm slide presentation).

9) Actively seek out speaking engagements where you can present your briefing.

10) Don't make mountains out of molehills and expect to pass them off as legitimate news stories to the local media. Be factual, truthful, and to the point.

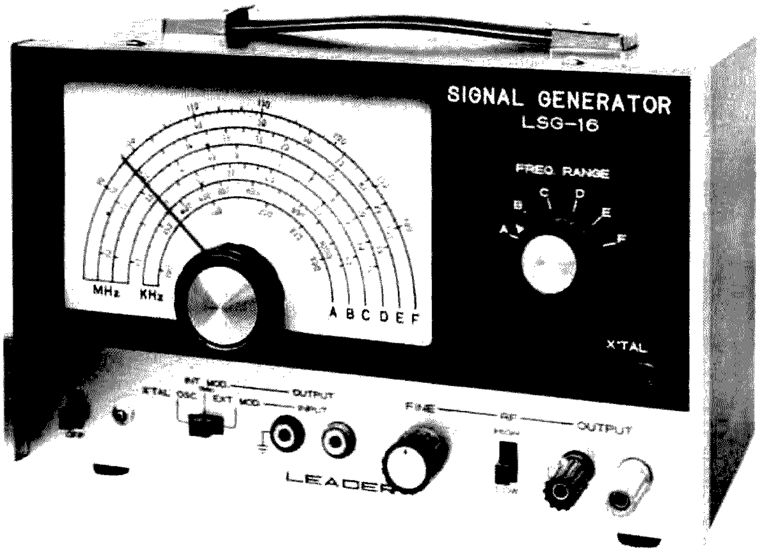
11) Avoid shouting matches with local CB groups; there's sufficient room for both activities, and bear in mind that while a stereotype of a CB operator has emerged, we have our own problem children.

12) Find projects that will benefit the local community – a massive campaign which tells what you can do in all types of future disasters is fine, but it's the present that counts.

...K3DSQ/4

NEW PRODUCTS

from page 19



LSG-16 RF WIDE BAND SIGNAL GENERATOR

The LSG-16 wide band signal generator, pretty darn good for service, hobby, education or industrial use, is now being made available by Leader Instruments Corp. of Plainview, N.Y.

The new product features an FET oscillator circuitry for high stability performance, plus an accurately calibrated frequency dial. Frequency range is 100 kHz to 100 MHz, and up to 300 MHz on harmonics. Internal modulation is 1 kHz at 30% or higher, while external modulation is 50 Hz–20 kHz at less than 1 Vrms.

The LSG-16 is capable of functioning as a marker-generator when used in conjunction with a sweep generator, and will check and align rf and i-f circuits in TV, FM and communication-type receivers and transmitters. Use of the product is further extended by provisions to accommodate a 1–15 MHz crystal.

The LSG-16 offers a 115/230 V, 50/60 Hz, 3 VA approx. power supply. Measuring 6"H x 10"W x 5"D, and weighing 5.5 lbs, it sells for $109.95.

HICKOK FUNCTION GENERATOR

So who needs a bunch of functions, you ask? Better yet, what is a function in the first place, and what on earth do we need with 'em?

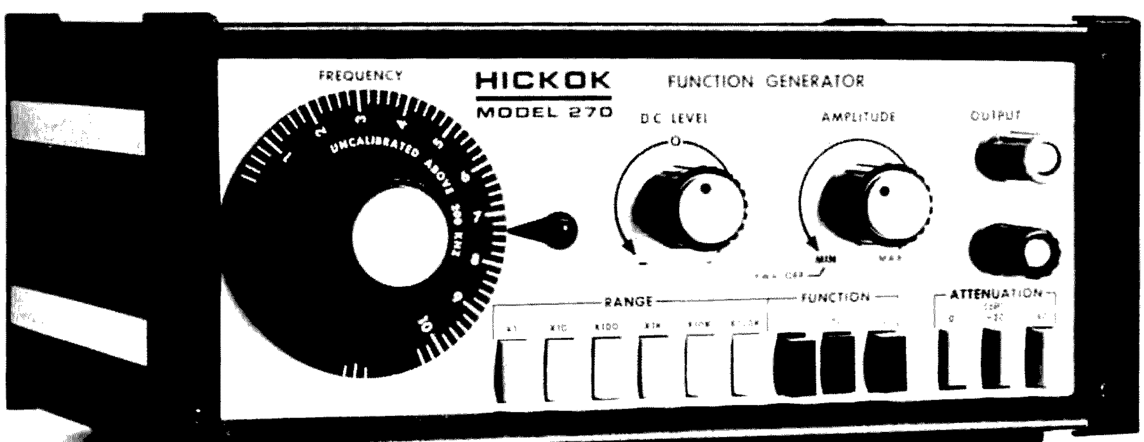
In olden days we had sine wave oscillators . . . a sine wave was one type of function. Then some smart guy came along and invented square waves . . . another function. Oscilloscope fans developed an insatiable need for sawtooth waves . . . still another function. The problem came when one piece of equipment could develop a lot of different types of waveforms . . . should they call it a sine-square-sawtooth-pulse-etc generator? No. So now we have function generators and they are getting pretty common . . . and the price has been going against the grain, being one of the few items to drop in cost.

Hickok, one of the older names in test equipment, has come out with a ham-priced function generator . . . model 270 . . . weighing in at only $166. This doohinky does not wash the dishes, but that's about its only limitation. From 1 Hz to 1/2 MHz in six push-button selected ranges, it will turn out sines, triangles, squares, and a variety of pulses, FM, AM/FM mixed, high/low combinations for testing filters, FSK for setting up RTTY gear and computer driven cassettes, AM, swept sine waves, etc.

Also built in is an attenuator going down to -60 dB for checking gain and filter action.

How much longer are you going to suffer along without a modern piece of test gear in your ham shack?

Further details are available from Hickok, 10514 Dupont, Cleveland OH 44108.

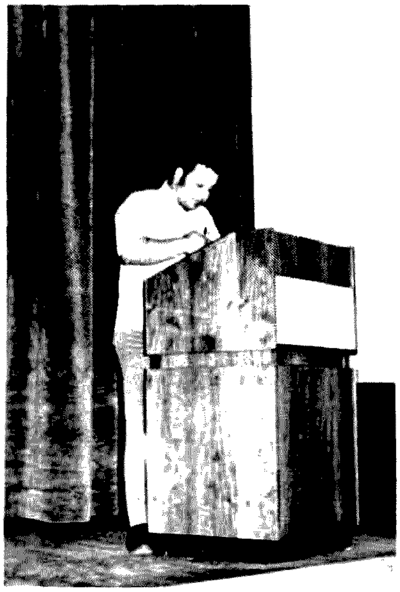


Looking West

from page 11

It's funny, but there is a simple solution to this problem, and maybe because I am just an onlooker I can see it. First, for the record, I can and do hear WR6AJL here in the Van Nuys area of the San Fernando Valley, and with the spring-summer inversion with us, their signal strength measured on a Hammarlund HQ-110AC using an Ameco CN-144 converter and Antenna Specialists ¼ wave Six Meter Vertical is S-8 to S-9 plus 10 dB since early May. Before approximately May 10th, I did not hear AJL at all though others claimed to have. As I said earlier, for my part I couldn't give a row of beans who uses .76 and for what, but if everyone would get off their damn ego trip and learn that it's not all that hard to cooperate with one another, then this whole mess could and would "go away" in record time.

It is a known fact in both commercial and broadcast radio that there are techniques available that will effectively "null" a signal from one area while totally saturating another: phased antennas, directional arrays, etc. By going to a directional system, AJL could survive and flourish along with L.A. simplex and the world could live happily ever after. AJL can serve an important purpose if its owners are willing to take the necessary steps toward that end and



SANDRA delegate responds to SCRA Technical Committee report and announces SANDRA's withdrawal from SCRA.

On tour of JPL after SCRA meeting, Bill Carpenter WA6QZY, SCRA Technical Committee Chairman, explains exhibit.

if, when the AJL signal disappears from LA on .76, so does the AKC signal on .16. All parties have the nation watching them at this moment. If action by either one of them causes failure within the SCRA, then I bid them both beware that such a failure here can and probably will have the most awesome consequences nationally. If the SCRA fails, then most probably it will be the lead for each individual who dislikes something within his area's coordinating body to work towards its destruction. Such would mean the quick end of relay type communication and a return to the "old days" where a VHF mobile could hardly work out of his backyard. I for one have no intention of sitting by and watching this happen.

It's about time we all realize that though we may not love one another as brother and sister, we are by federal decree neighbors in the same relay sub-band — repeater, simplex and remote. There is but one way for us to survive and that is through total open mutual cooperation. Mutual cooperation takes the form of area frequency coordinating groups such as SCRA and its counterparts throughout the nation. These are organizations built on naught more than a handshake, and if the handshake becomes a fist of rage, and each individual or group goes his own way because a decision made in the interest of all does not suit an individual, then all that we have worked for is lost and we might as well pack it in.

To all involved in the present confrontation, beware: The eyes of the nation are watching every move you make. There is a heavy burden on your shoulders, that of risking the destruction nationally of relay type communications by your actions here. There will be no replay of the old days; this time every move is being watched and being reported. If either party destroys it for the rest of us, then the world will quickly know who is responsible.

A late note: It has been announced that some 15 San Diego Area systems have written to SCRA pledging their support of the organization. SCRA has also stated that it will continue to take whatever steps are necessary to insure a quick solution amicable to all parties.

Other matters covered at the recent SCRA meeting included setting definite jurisdictional boundaries for the organization to administer, action on docket 20282 and the SCRA proposal to the FCC to take part in repeater licensing for Southern California. As to the latter, in a letter exploring such possibilities sent to the FCC, the SCRA proposes that VHF repeater Form 610 applications would be pre-processed and sanctioned by the SCRA prior to FCC filing for a one year test period.

Finally, in answer to a load of mail that all but broke the back of our local postal delivery person, following the publication of my dissertation on split-split repeater systems, the following is the information that I have on where to get some narrower filters for radios using the Mu-Rata brand filters. The address I have is: Mu-Rata Corp. Ltd., Elmsford NY. Thanks to Lou K2VMR for supplying this information. Till next month, that's all there is for now from the "Hot" Southland.

. . . WA6ITF

CONTESTS

from page 15

316). DX stations may be worked, but do not count as multipliers.

AWARDS:
All amateurs contacting 5 amateurs in each of the 4 states comprising the Division will receive the Delta Achievement Award. Certificates will be awarded to the 3 highest scoring stations in each state in the Delta Division. Fourth and fifth place awards if warranted. Outside the Division, certificates will go to the high scoring station in each ARRL Section and country (second and third if warranted). A plaque will be awarded to the high scoring station both inside and outside of the Division. Plaques will also be awarded to the high scoring portable and mobile stations operating in the Division. A portable or mobile station is here defined as a station operating outside of his home county for the purpose of operating in the Delta QSO Party. Any station disrupting a working Delta Division traffic net or whose log exhibits obvious irregularities will be disqualified from award consideration.

LOGS:
Logs must include date/time, station worked, exchange, band, emission and multiplier. Logs must be postmarked no later than October 21, 1975, to be eligible for award consideration. Logs will be returned if requested. Send logs to Malcolm P. Keown W5RUB, 213 Moonmist, Vicksburg MS 39180.

1975 RTTY ART CONTEST
Contest period runs from October 1st to end of November

PRELIMINARY RULES:
Original RTTY art must have been transmitted during this two month period, with copies and prints being mailed on or before a deadline of November 30th. The contest is sponsored by the RTTY Journal. Mail entries to: Donald Royer WA6PIR, 16387 Mandalay Drive, Encino CA 91436.

CALIFORNIA QSO PARTY
Starts: 1800 GMT Saturday, October 4
Ends: 2400 GMT Sunday, October 5

The 1975 California QSO Party is sponsored by the Northern California Contest Club. Of the thirty hour period, the maximum operating time shall not exceed 24 hours. Times on/off must be clearly marked in the log. Each time off shall not be less than 15 minutes. All amateur bands may be used, and stations may be worked once on phone and once on CW on each band. A California station which changes counties is considered a new station and may be contacted again on each band and mode.

EXCHANGES:
California stations send QSO number and county. All others send QSO number and state, province or country. California stations may work each other.

FREQUENCIES:
CW: 1805, 3560, 7060, 14060, 21060, 28060. SSB: 1815, 3895, 7230, 14280, 21355, 28560. Novice: 3725, 7125, 21125, 28125. Try 10 meters on the hour and 15 meters on the half hour between 1800 and 2200 GMT.

SCORING:
Each completed QSO counts 2 points. California stations multiply QSO points by the total number of states and Canadian call districts (VE/VO 1-8; max. of 8). California stations may count the State of California as one multiplier and DX stations may be worked for QSO points but not multipliers. All other stations multiply total QSO points by the number of different California counties worked (58 maximum).

AWARDS:
Certificates will be awarded to the highest scoring station in each California county, state, province, and country. Second and third place awards may be made where justified. In addition, certificates also will be awarded to the highest scoring mobile station, portable station, multi-single, and multi-multi entries. A certificate will be awarded to the club submitting the highest aggregate score.

LOGS:
Log information should include date, time, band, mode, callsigns worked, and exchanges sent and received. Please number each new multiplier as worked. A summary sheet should be included showing your callsign, name, address, number of QSOs on each band and mode, total QSOs, total multiplier, claimed score, and whether the entry is single or multi-operator. All entries must be sent to the NCCC, c/o John Minke W6KYA, 6230 Rio Bonito Drive, Carmichael CA 95608, and must be postmarked not later than October 31, 1975. A large, business-size SASE is requested with each entry. All comments and suggestions will be appreciated.

ROCKY MOUNTAIN QSO PARTY
Starts: October 4
Ends: October 5

The contest is sponsored by the Rocky Mountain Division of the ARRL. The states participating in this QSO Party are Colorado, New Mexico, Utah and Wyoming. Each state is having a separate QSO Party.

CONTEST PERIODS:
2100 GMT to 2400 GMT October 4
0100 GMT to 0500 GMT October 5
1800 GMT to 2100 GMT October 5

EXCHANGE:
Serial number, RST, state and county for stations in the Rocky Mountain Division, while others may omit the county. Stations may be contacted only once per band regardless of mode, except that mobiles may be contacted again if they change counties. Intradivision and intrastate contacts are valid for stations in the Rocky Mountain Division.

FREQUENCIES:
CW: 65 kHz up from the bottom. Phone: Near the edge between General and Advanced. Novice: Near the middle of each band. Stations from outside the division please refrain from calling CQ Contest near these frequencies.

SCORING:
Score 1 point per QSO. Multiplier for Rocky Mountain Div. stations is the sum of states, VE provinces, countries, and Rocky Mountain Div. counties. For all others, the multiplier is the number of counties worked in the state in whose party he is participating. There will be 4 different multipliers, one for each state, for those that enter all 4 contests.

AWARDS:
Appropriate awards will be given.

LOGS:
Send full log data, including exchanges, to Bill Wageman K5MAT, 35 San Juan, Los Alamos NM 87544, no later than November 1, 1975. Include SASE for awards and/or copies of the results.

... de W2NSD/1

EDITORIAL BY WAYNE GREEN

from page 12

73	*223*
QST	*181*
HR	*128*
CQ	*77*

That comes to about 23% more ads in 73 than the next magazine. This may be of interest to amateurs getting ready to start new companies in the ham field who are looking for the magazine which provides the lowest cost ads in terms of sales results . . . and that is the bottom line. It may also interest the sales managers of the few firms which are not advertising in 73 because they disagree with the editorial policy and hope to force a change with economic sanctions. Ads in 73 outsell anyone else . . . which is the reason there are more in 73.

YOUR PROTECTION

Another major firm has been kicked out of the 73 pages . . . for a variety of reasons. Since they are threatening to sue us to force us to accept their ads, we'll have to keep mum on the situation for legal reasons. We really can't even tell you who they are . . . but if any readers have been having any problems with Emergency Beacon for any reasons it wouldn't hurt to drop us a line with the details . . . we may be able to help.

FREE PHONE CALLS

For a period of several years (alas, no more), those in the know were able to make long distance phone calls for free. It seems that when you put in a TWX system it came with a telephone connected to it, said phone having a solid cover on the mouthpiece since the teletype machine was to be used over the phone wires. Now it further appears that Bell was having a lot of trouble with TWX systems getting wrong numbers as a result of less than diligent servicing of the switching equipment, and the resulting misbilling was cured by having the computer bill only for calls to TWX numbers. TWX users, upon discovering this cute system, unscrewed the solid part of the handset and put in a regular microphone, thus enabling them to make calls at will over the TWX line, knowing they would not have to pay because the computer would reject the billing. This little game went on for several years, claim people who took advantage of it.

. . . W2NSD/1

Caveat Emptor?

from page 16

CALL LETTER LICENSE PLATES — still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate — most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

TECH MANUALS — $6.50 each: R-220/URR, SP-600JX, USM-34, GRR-5, URM-25D. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

MANUFACTURERS, Distributors! The Memphis Hamfest will be bigger than ever. The dates are Saturday and Sunday October 4 and 5. Best location possible — State Technical Institute, Interstate 40 at Macon Road. Security. Contact Chairman, Harry Simpson W4SCF, Box 27015, Memphis TN 38127, phone (901) 358-5705.

RADIO ARCHIVES, amateur ANECDOTES (then & now) solicited for proposed (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 fourth St. N., Mpls., Mn. 55412.

HT220 HI-BAND 4 freq. universal $250.00 D.M. Herlihy, 2338 Berry St., Lemon Grove, Calif. 92045.

POLICE AND FIRE Scanner Special — Regency ACT — R — 10 H/L/U 10 channel 3 bands, combined ac/dc 10 free crystals included $169.00 prepaid, dealer inquiries invited, Four Wheeler Communications 10-F New Scotland Avenue, Albany NY 12208.

NEW EBC 144 JR: The dream machine costs $599.00. First cashier's check for $495.00 gets it shipped the same day. Still under warranty. M. T. Henry, 5173 North Hampton Ridge, Norcross, Georgia 30071.

LOOKING FOR JAN 1961 issue 73 Magazine. Please write, stating price, only mint condition. All letters answered. R. H. Wilson, 4011 Clearview Drive, Cedar Falls IA 50613.

FOUNDATION FOR AMATEUR RADIO annual Hamfest Sunday, 19 October 1975 at Gaithersburg Maryland Fairgrounds.

FOREIGN LANGUAGE cassettes. 2 — 60 minute quality tapes per set. French, German, Italian, Spanish. $6 a set, 4 sets $20. Royal, Box 2174, Sandusky, Ohio 44870.

WANTED: CX-7 Dead or Alive, write price, condition, symptoms. SELL: VRM26A, manual, spare tube. Trade for 2 mtr or HF rig. Rob Pohorence, 2334 Regal Court, Lawrenceville, Ga. 30245. WB4RSK.

SSTV ZOOM LENS, 12-48 mm, F 1:8 focusing C mount, (Robot, Venus, HCV, etc.) brand new, closeout, $64.95 each postpaid, UHF, Box 504, Huntington Station, New York 11746.

TWO PLASTIC HOLDERS FRAME and display 40 QSL's for $1.00 or 7 holders enhance 140 cards for $3.00 — from your Dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin, Tennessee 37066.

WANTED: Mobile telephone equipment such as Delco, GE, etc. Also heads, decoders, duplexers. Greg Hyman, WA2OTG, 19 Sicard Ave., New Rochelle, New York 10804, (914) 636-2494.

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester NY 14612.

HAM HELP

According to long-standing policy, *73 Magazine* makes a continual effort to match those in need of technical help or instruction with those who feel they can offer it. If you find yourself in one of these two categories, please do yourself and amateur radio a favor by contacting Ham Help, *73*, Peterborough NH 03458.

Lawrence R. Harrington
1503 E. Walnut Avenue
El Segundo CA 90245

Steve Dobrenchuk WN3YQB
122 Grafton Street
Chevy Chase MD 20015
(301) 652-3150

Freeman Dodsworth
5302 Pooks Hill Road
Bethesda MD 20014
(301) 530-3674

James F. Reuter, Sr.
2595 Marlborough
Detroit MI 48215
(313) 821-0395

Edward A. Smith
55 East End Avenue (82nd St)
Apartment 4G
New York, NY 10028
(212) 879-6580

Add my name and address to your list of those willing and able to give constructive assistance to those that need help – W9EQG dates from 1954. I can help in amateur radio and basic and advanced electronics.

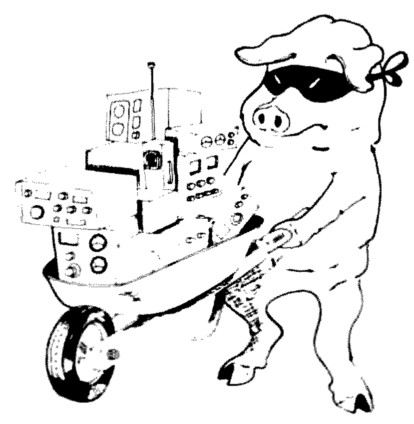
David R. Halliburton
WA3ZOR/ex-W9EQG
726 Tiffany Court
Gaithersburg MD 20760

The Hamburglar STRIKES AGAIN!

STOLEN: Two miniature GE portable radio transmitter/receivers; model number PE56RAS66, S/N 2210672 and 4351289. Contact John E. Dillon, LtCol, USAF, Chief, Security Police, Department of the Air Force, 3800th Air Base Wing (AU), Maxwell Air Force Base, Alabama 36112.

TAKEN: SB-144 was stolen from locked auto on June 28, 1975 at the "Tradewinds" Shopping Center at Barrington and Irving Park Road in Hanover Park, Illinois. S/N 620952. Internal speaker is removed and a Data Engineering Pre-amp is installed in its place. Contact Mr. D. L. Holdeman W9HJL, 1510 Birch Avenue, Hanover Park, Illinois 60103. Phone: (312) 289-1919.

RIPPED OFF: Tempo One & AC PS and Drake TR-22 taken on June 14, 1975. Contact Dennis J. Gazak WA3SZD, 321 Stevens Street, Philadelphia, Pennsylvania 19111.



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J.H. Nelson

Good (open) Poor (0)
Fair (□)

September – 1975

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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7	8	9	10	11	12	$\boxed{13}$
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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	7	3	3	3	7	7	7	14	14
ARGENTINA	14	7	7	7	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	7B	7B	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	7	7	7	7	7	7A	14	14	14	14A	14A
ENGLAND	7	7	7	7	7	7	7	14	14	14	14	7
HAWAII	14	7B	7B	7	7	7	7	7	14	14	14	14
INDIA	7	7	7B	7B	7B	7B	14B	14	14	7	7	7
JAPAN	14	7B	7B	7	7	3	7	7	7	7	7	14
MEXICO	14	7	7	7	7	3A	7	14	14	14	14	14
PHILIPPINES	14	7B	7B	7B	7B	3B	7	7	7	7A	7B	14
PUERTO RICO	7	7	7	7	7	3A	7A	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7B	7A	14	14	14A	14	14	14
U. S. S. R.	7	3	3	3A	3A	7	7	14	14	14	7	7
WEST COAST	14	7	7	7	7	3A	7	7A	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	3	3	3	7	7	7A	14	14
ARGENTINA	14	14	7	7	7	7	7	14	14	14	14A	14A
AUSTRALIA	14	14	7B	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	7A	7	7	7	7	7	14	14	14	14A	14A
ENGLAND	7	7	7	7	7	7	7	14	14	14	14	7
HAWAII	14	14	7B	7	7	7	7	7	14	14	14	14
INDIA	7	7	7B	7B	3B	3B	7B	7	7A	7A	7	7
JAPAN	14	7A	7	7	3	3	3	7	7	7	7	14
MEXICO	14	7	7	7	7	3	7	7	14	14	14	14
PHILIPPINES	14	14	7B	7B	3B	3B	3B	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	3	7A	14	14	14	14	14A
SOUTH AFRICA	7	7	7	7	7B	7B	7A	14	14	14	14	14
U. S. S. R.	7	3	3	3	3	3B	7	7	14	14	7	7

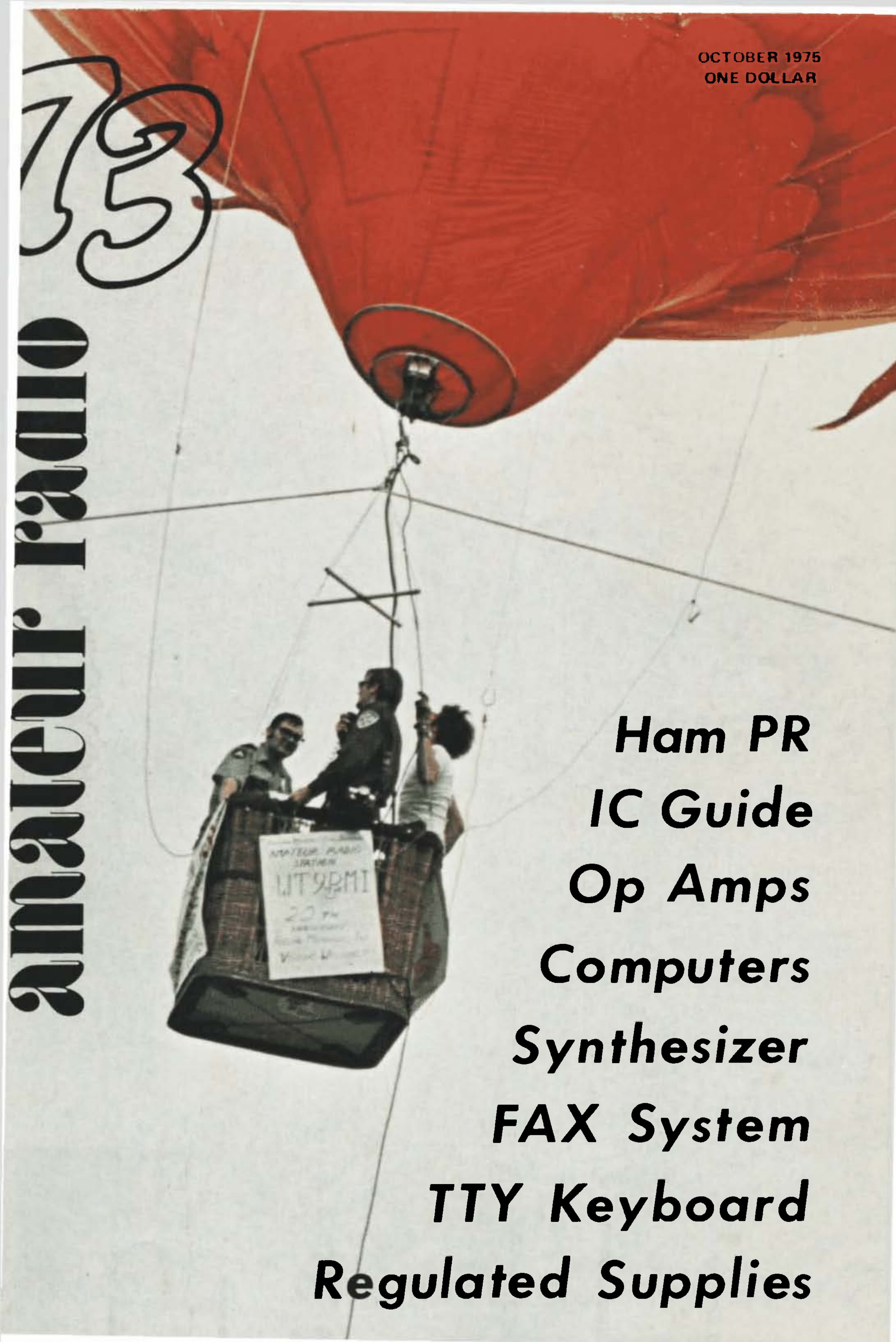
WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	3	3	3	7	7	7	7	7A
ARGENTINA	14	14	7B	7	7	7	7B	14	14	14A	14A	14A
AUSTRALIA	14A	14A	14	7B	7	7	7	7	7	7B	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	14	14A
ENGLAND	7	7	7	7	7	3B	7	7	14	14	14B	7
HAWAII	14A	14	14	7	7	7	7	7	14	14	14	14
INDIA	7	14	7B	7B	3B	3B	3B	7	7	7	7	7
JAPAN	14	14	7A	7	7	7	3A	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	3B	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	3A	7	14	14	14	14A	14
SOUTH AFRICA	7	7	7	7	7B	3B	7B	7A	14	14	14	14
U. S. S. R.	7	3B	3	3	3	3B	3B	7	7A	7A	7	7
EAST COAST	14	7	7	7	7	3A	7	7A	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 amateur radio

OCTOBER 1975
ONE DOLLAR



Ham PR

IC Guide

Op Amps

Computers

Synthesizer

FAX System

TTY Keyboard

Regulated Supplies

73 amateur radio

#181 OCT 1975

COVER: Photo courtesy of Karl Schulte WA2KBZ. Article begins on page 160.

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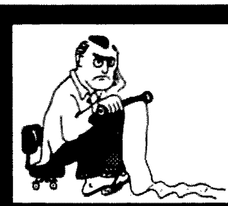


NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

ARE THE FUN MACHINES GOING SOUR?

A couple of years ago I began to notice a definite change in repeater operating. I thought it was just up in New England, but the more I got around the country, the more I found that the pattern was appearing just about everywhere.

Scene: A visitor in a new area with a two meter FM rig in his car. He kerchunks a repeater and finds that the signal is excellent. Next he calls in, using universally accepted procedure ... "K1FYP mobile one standing by." All is okay so far, but what happens next?

In most cases our visitor will hear absolutely nothing. In perhaps 20% of the cases he will be met after a few seconds by, "K1APA, this is WA1EJU, are you on frequency?" Thus our visitor knows that not only are there people listening to the repeater, but that they are going out of their way to let him know that they don't want to talk with him.

Does this happen on your repeater?

A recent visit to San Antonio resulted in this happening to me at least six times, with the only contact made being with another visiting mobile. I never did get an answer from one single local amateur! In Dallas I did a little better, but the result on most repeaters was as above. Ditto Phoenix and Albuquerque. Not ditto Salt Lake, thank heavens.

You don't have to be a visitor to have this happen to you either. I hear it happening every day to most ops who just come on and announce that they are available for contact.

Now, before you get uptight and defensive about this, let's take a look at a possible cause of this phenomenon. I suspect that it is a natural result of the present FCC regs. I won't go as far as to say that I think the rules are ruining FM, but a good deal of the fun sure has gone out of it for a lot of us.

The probable culprit, I suspect, is that abomination, the three minute timer. In the day when there were more operators than repeaters and there was some rational reason for limiting the time any user could talk, perhaps a timer made sense. But today, when most repeaters are just sitting there unused, timers serve no practical purpose. To the contrary, they put a heavy weight on any attempt at a contact.

So how many times will you call some chap who you don't know and go through the usual repeater routine of getting his name, what he is using, where he is located, and the over, before the clock turns the repeater off? The next brief burst of talk has no time to get anywhere and both of you decide the best bet is to just shut up and "leave the repeater for someone else to use." Baloney, they don't have any better use for it than you do, so it sits there silently, a monument to restrictive legislation.

If anyone figures out how to get an interesting contact going under these conditions, the pages of 73 are wide open. We desperately need a breakthrough like this to save FM and repeaters from a boredom which is almost beyond description.

Sure, once you get to know some chaps you can jolly with them, and you may even be able to get an interesting conversation going. It's rare, as any dedicated repeater listener will testify, but it does happen. But with a newcomer? Hardly ever.

Let's put it this way: If you ever chance upon a contact that you find really interesting on a repeater I sure wish you would quickly turn on a cassette recorder and tape it so I can hear this epochal contact. Surprise me and get me to apologize.

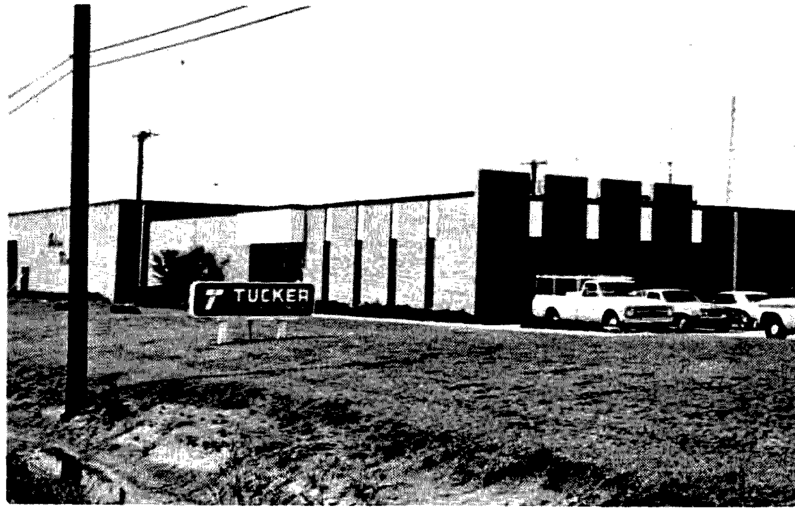
In the meanwhile, now that what's his name is out of the driver's seat at the FCC, let's see if we can get those repeater regs improved. Honestly, can you think of any good reason for a three minute timer these days? Just because commercial repeaters need them is not a valid reason for amateur repeaters. How about five minutes... or even ten? If you'll give me ten minutes I'll not only talk your ear off, I'll be interesting ... and I'll have a chance to get you going on something

that you enjoy and that I want to hear about.

Anyone out there feel like petitioning the FCC to get rid of that three minute nonsense?

Okay, I know, there are some repeaters where there are so many users that there just has to be a timer. But does this mean that *every* repeater has to have one? And I'll bet you that the no time out repeater will be a lot more interesting to monitor than the timed ones. Any takers on that bet?

If you listen around the country as much as I do, you'll soon find that about 90% of the repeaters are not being used 95% of the time, and that is a lot of non-use. Obviously something is wrong . . . if it isn't timers, what is it?



Tucker Electronics in Richardson, Texas. Well worth a visit if you get in the Dallas area. Fantastic selection of ham gear, new and used.

SUGGESTION

As an interim solution to this growing misery, perhaps some frank discussion at the next repeater club meeting might be in order. It wouldn't hurt to try to work out some stop-gap measures such as a firm vow to encourage those chaps monitoring the repeater to make an effort to be hospitable to visitors.

Even after almost forty years of trying to cope with getting into interesting conversations on the air I have little to offer. Sometimes the chemistry is there and we have a great time — sometimes there is no way in the world that I can get the other chap to make an interesting contribution to the contact. It's a lot easier with fellows I've known personally, of course, since we've had the opportunity to pursue some duplex eyeball conversations and have thus established some areas of mutual interest other than my magnetic mount antenna.

At any rate, let's try to do what we can to remember that FM means Fun Mode and make repeaters fun for everyone we hear coming through.

BYTE Trip

With more and more gear coming on the market for the computer hobbyist, and with the first issue of BYTE in the mail, I took off a few days to get out west and see first hand what was going on in the small computer systems business. Naturally I took along a 2m rig.

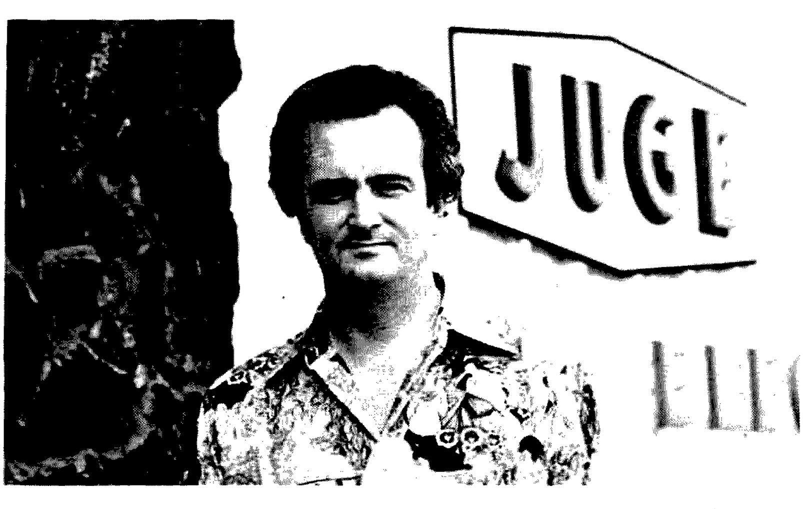
The first stop was Salt Lake and a visit to a brand new firm, Sphere Corp., which is getting ready to put out a Motorola M6800 based computer system. Their $650 kit includes a computer, keyboard and output for using a television set as a monitor. They had their system up and running when I visited, with a couple small bugs to work out before getting into full production (which should be a fact by the time this reaches print). Their plan is to use an audio cassette system for inexpensive bulk memory storage.

Next I visited MITS in Albuquerque, and got a good look at their Altair 8800 computer system which they have working. The Altair, which was introduced back in January, uses the Intel 8080 microprocessor chip, and MITS says they have shipped over 5000 units to date. The Altair runs $439 in kit form and $621 assembled and checked. I've had letters from many 73 readers who have put this one together.

My next stop was Southwest Technical Products in San Antonio, where I got a real surprise. SWTPC has been selling an inexpensive television typewriter kit which is great for Teletype use, or as a computer input/output unit. I'd put one together a few weeks ago and it worked great. However, I don't recall the TV Typewriter even being mentioned during my visit . . . their soon to be released M6800 computer kit was the main subject. They had the unit working and gave me a demo. This should be ready in kit form by mid-November.

MITS had a couple of surprises for me. One was the news that they will soon be announcing an M6800 based computer in addition to their 8080 unit. The other was how well their 8800 system worked. They loaded the computer from a cassette with Basic language and it was soon ready for setting up programs of considerable sophistication. It was at about this time that I stopped thinking of microcomputer systems as being inferior to

Continued on page 126



Ed Juge in front of his place in Ft. Worth — just off the freeway. Ed is one of the nice guys in the ham business — so be sure to say hello to him.

BE MY GUEST

Visiting views from around the globe.

"Thank God for Amateur Radio"

73 is happy to be able to present this comment, along with the letter to which it refers. The Indian River Amateur Radio Club of Florida is certainly worthy of emulation. — Ed.

This is my first letter to a ham magazine. I am writing in to protest the way I was treated while working for my Novice license. I do, however, want to say that I have met a few amateurs who did help me. But for the most part I was treated as if I did not exist. I did join an amateur radio club, only to find the club was of little or no help. When I would ask one of them to help me with code they would say they had no time. When I would ask one of them to help me with theory the answer was there was nothing they could do to help me. Well, the fact remains that I am one of those people who, finding a wall in front of him, will fight to overcome it, and I did — I have my Novice license and the thing that kept me going was the thought of being able to walk in and tell them that even without their help I got my license. Most people are not like that — if they hit a wall like that they give up. Proof of that is shown by the fact that I brought 3 friends who are very interested in radio to the club and only one of them stayed. I think these hams who think themselves so great had better wake up to the fact that they are going to lose to CB operation many would-be hams because of their way of treating newcomers.

Wayne S. Gateman WN1UXS
Newton Centre MA

This comment is in response to Wayne WN1UXS, who wrote in the August 75 issue that he had trouble getting help from local hams in Newton Centre, Mass., when he was working on his Novice ticket.

Well Wayne, this is also my first letter to a magazine, but my story is quite different. I am a 54 year old aspiring Novice, disabled from heart disease, having had open heart surgery twice in the past three years and been in the hospital 16 times in that same period. I learned the code in the hospital as I did the theory, BUT, and a BIG BUT at that, I had help. A lot of it too, and it all came from those guys that you referred to as "hams who think themselves great".

They found out about my desire to be a ham, one I've had for over forty years, but was always too busy to start. Then they brought me the appropriate ham publications to study, a key with an oscillator, and a code course on tape. They advised me on the purchase of my gear, put up my antennas, then invited me to join their club. They have contributed many hours of their own time in a school for aspiring hams. They annually put on an Amateur Radio Course through the local adult education system at our high school. It is a 16 week course, two nights a week, that only costs $2.00. The instructors are all members of the Indian River Amateur Radio Club. They volunteer their time. They have bought and given to eight libraries (four of them high school libraries) complete sets of ham publications.

Yes Wayne, they are a great bunch of guys. They enjoy their work and ham radio. A recent example of this is one which I was happy to participate in. A black family moved into an otherwise white neighborhood. No one burned them out. Instead they found out he was disabled and also a ham, so they put up a tower, rotor

Keep Breathing

Down in the village last week, we ran across one of the local QRPers, newly entered on the Honor Roll. We had expected that this one would be happy. He was not.

"Sure I made the Honor Roll," he said, "but I'm right on the bottom level. Right as low as you can get. And with no action in some of the DXCC countries for fifteen years or more, and all those deleted countries, I'll most likely stay right on the bottom. Honor Roll? Big deal!!"

We thought this over for a bit, figuring that it would help to keep him talking. The QRPer shrugged at our urgings.

"Look," he said, "sure I started late and was not DXing until I was twenty eight years old. But with all those inactive countries plus those deleted ones, the only way I can gain on those high numbers is to out-live them. The only way, and already I'm getting around the bend myself. A long ways around the bend!"

Son of a Gun, what could we say to all of this? For truly the Honor Roll honors those who started early and stayed late. And a late starter may never get by the lower echelons. And it has been noted that those DXers with a strong hope for posterity remembrance and the burnishing of the family name are the ones who do not enroll their eldest son in an Ivy League college at a tender age but get him DXing. All you need is a half century ahead of you and you are bound to be among the honored. And the pure in heart and the avoidance of tobacco, alcohol, night air, wild women and other distractions will certainly help.

But most of all, keep breathing . . .

Reprinted from the West Coast DX Bulletin, *August 12, 1975.*

"count to three"

Here, reprinted from Communications News, *is an interview with Charlie Higginbotham, which provides some insight to how things are going with amateur radio FCC-wise. Reprinted by permission of* Communications News, *August, 1975, Ken Bourne K9GHR, editor.*

Charles Higginbotham, chief of the FCC's Safety and Special Radio Services Bureau, was recently interviewed by CN Managing Editor Ken Bourne on matters currently affecting two-way radio users.

Prior to his appointment, Higginbotham had been chief of the Industrial and Public Safety Rules Division. He joined the Commission in 1948 as an electronics engineer. Before coming to the FCC, he had worked with United Airlines and had served in the United States Navy. He attended the American University and is a registered professional engineer. He has participated in many areas of the Commission's responsibility including Broadcasting, Marine, and, for the last 20 years, has been involved in rulemaking and regulatory activities in the private landmobile and microwave services (Public Safety, Industrial, and Land Transportation). He is a Fellow of The Radio Club of America.

The following interview took place on June 5, and began with a discussion on the temporary stay issued by the United States Circuit Court of Appeals against granting licenses for operation on 900 MHz. (The stay has since been lifted, with respect to private and cellular systems.)

BOURNE: *Were any licenses about ready to be issued before the United States Circuit Court of Appeals ruling on the temporary stay?*

HIGGINBOTHAM: No. They were not. The temporary stay was issued some weeks ago. The only application we had pending, I believe, is one of the City of Chicago. I believe that that was referenced in our filing with the Court. I believe we had one other application submitted on a Form 400 with a request for waiver that he be permitted to file, in advance of the availability of our attachment which the Commission adopted, and said we would not accept applications until the form was approved, and that form has not yet been approved. (Editor's note: Since this interview was made on June 4, the form was approved by GSA.) So that's where we stand. We are just marking time until we see what the Court does with the stay.

BOURNE: *Has any 900 MHz equipment been type-accepted by the FCC?*

HIGGINBOTHAM: I believe there is one piece of 900 MHz equipment type-accepted, by Motorola. That I believe is a conventional transmitter.

BOURNE: *How many proposals in the Safety and Special Radio Services Bureau are currently awaiting final rulemaking?*

HIGGINBOTHAM: We have Aviation, Amateur, Marine, Citizens and Land Mobile. I think we are fairly current on pending rulemakings. I don't believe we have very many loose ends hanging. The Commission recently concluded the Public Safety nonvoice rulemaking.

BOURNE: *That was just for Public Safety, correct?*

HIGGINBOTHAM: Yes. We had, a number of years ago, amended the Industrial rules to provide for the two-second nonvoice operations. The Public Safety rules in the Police and Fire area are a little bit different. They allow the continuation of the taped voice alarms, where they indicated there was a need for the patrolman on the street or the automobile to get a direct verbal message rather than some sort of a digital readout in the car.

BOURNE: *Speaking of nonvoice, do you personally expect ATIS (the FCC's proposal for automatic transmitter identification systems) to work?*

HIGGINBOTHAM: It depends on what you mean by "work". If you are asking me if it's technically feasible, the answer to that is, I don't think there's any real question. We have systems in operation today in our various services, and each, of course, noncompatible with the others, but any one of them, I think, is probably capable of performing the automatic transmitter identification function. I think it gets to be more difficult when we start talking about devising a single system, because that means that you have to pick a system out — and

---

and a six element beam. It took three weekends, but it was a great experience. The food served by the grateful ham's wife made it all worthwhile.

You might ask who these guys are who are doing so much? Well they are the same guys who are part of a team at the Space Center which put Oscar 6 and 7 in orbit, our men on the moon, launched numerous Titans, Minutemen and Poseidons — and now have added Apollo/Soyuz to that long list. They are also the local Little League coaches, Sunday School teachers, Scout leaders, Coast Guard Auxiliary and whatever else you might want to add.

Yes Wayne, I feel sorry for you and your community if the local hams are indeed as you have described them. I find that hard to believe with my experience. Let us not judge them that way. Maybe you didn't approach them properly. Maybe your attitude wasn't just right. I don't know what it was, but I sure hope it has corrected itself.

Amateur Radio is alive and well here in the deep South, and if you or anyone reading this is ever in our area, PLEASE feel free to join us at our meetings. The coffee and donuts are on us.

Thank God for Amateur Radio and for the Indian River Amateur Radio Club.

Joe Rubino
Cocoa Beach FL

maybe one that is in current use or maybe one nobody uses — and then everyone has to convert to that. So I think there is some reluctance on the part of various manufacturers to proceed. Some of them feel that when you do that you freeze the state of the art. That may be true, I don't know.

BOURNE: *What would prevent, say, an unscrupulous dealer from programming in some "noncall signs" on a CB radio, once this went into effect?*

HIGGINBOTHAM: Nothing.

BOURNE: *Is there any way you can prevent that from happening by insisting on a particular design?*

HIGGINBOTHAM: In CB, at least some manufacturers have indicated maybe one way to do it is to build into it, at the factory, the serial number. That certainly is a workable system, if you bear in mind that probably any system that could be devised can be defeated. It's probably easier to jury rig the device by putting in phony call sign, if it's done by a dealer or service man. But that compounds our problem if we go the serial number route, because it means we then do not have a record of licenses, but a record of every transmitter sold. That could get to be a pretty big and expensive data file.

BOURNE: *The FCC has stated that the Class E CB docket has been deferred, pending the outcome of several other dockets, including ATIS. That would bring up the question, what would prevent a Class E CBer from purchasing an Amateur Radio transmitter on the 220 MHz band and putting it on Class E – whether it's 218-220 MHz or whatever your current thinking is for a Class E band?*

HIGGINBOTHAM: I think there is a very good chance that will happen.

BOURNE: *So that would defeat ATIS entirely, wouldn't it?*

HIGGINBOTHAM: Yes, it would. As a matter of fact, I think there is a good chance that if we have Class E, it will bring about some rise in unauthorized operation in the Amateur bands. I am more concerned about that than the other way. I think the bulk of CBers will not try to defeat the circuitry. You see, with the present system, with off-the-shelf equipment, and partly encouraged by dealers, maybe substantially encouraged by dealers, they have said, maybe in the interest of making an immediate sale, "I'll make this equipment immediately and to ensure that other people will talk to you, why don't you use a handle, and here is a list of handles." I know a lot of that is going on. In my speech at Las Vegas (NEWCOM show), I covered that point. I also admitted that, while I had some problems with the way the industry had gone, the FCC was not entirely blameless, because we sort of failed to try to shoulder our enforcement. And we have had and have unrealistic rules. Docket 20120 is intended to kind of get started towards bringing the rules into the real world. They still need a lot of reregulating. They need to be written in words that people can understand, and they could be less verbal. I think the fact that the Commission agreed to propose to expand the Class D Service indicated it hasn't given up hope of making a better order service out of it.

BOURNE: *But just listening to it, it almost sounds hopeless. Do you, personally, listen to CB?*

HIGGINBOTHAM: I have to confess I don't. I've been thinking about buying a unit and setting it (in my office).

BOURNE: *How about the Commissioners? Do any of them listen to CB?*

Continued on page 97

Dig it out and loan it

At various times comments have appeared emphasizing the need to get more young people involved in Amateur Radio. At the present time junior high and high school students are not financially encouraged to stick with ham radio. Think about the prices you saw last time you browsed through your local radio dealer's showroom. Even the most basic, used Novice station will cost about $100. For a young student that is a tremendous amount of money.

And then think of how you might react if your son (or daughter) came home and announced that he wanted to spend all of his savings on an old battered piece of hobby equipment. And if the Novice does persist and get his General license, the situation does not improve. Even the simplest SSB station will cost $500 or so when you include the power supply and a microphone. Think about when you were in high school. It was hard enough to save $30 so you could take your girlfriend to the prom. It must be a bit discouraging for young hams to look at the "bargain" prices of ham rigs advertised in the magazines.

The young ham might get a part time job, but it won't be easy for him to go to school, do his homework, a few chores around the house, work part time, and still have any time left to do some operating.

As for building, it is impossible for an inexperienced builder with a small junk box to build a complex multiband SSB rig with the same versatility and ease of operation as the commercial equipment for a lower price.

So, what can we do about all this? Well, for starters, remember that old Novice rig of yours that is stored away in the corner of the basement? Dig it out and loan it to that junior high boy who just passed his Novice test. Spend a few minutes showing him how to use it and you won't have to worry too much. I can guarantee that the rig will get some use instead of gathering dust.

Or, invite a Novice over to your shack some evening and let him work some DX. Very few Novices have a beam or a linear, and would get a thrill out of using yours for an hour or two.

Help the high school radio club set up a station. If your local radio club doesn't have a club station, set one up and make it available!

It doesn't take much on your part and it might stop some valuable young hams from dropping out.

Mark Aaker WB9NAI
Eau Claire WI

LETTERS

MORE OF THE GOOD. . .

James Electronics
PO Box 822
Belmont, California 94002

Gentlemen:

Many thanks for your fast efficient service. I was dazzled! It's been years since I had such courteous service. The S6 order was mailed 26 July and the semiconductors were received 31 July. Unbelievable!

My two meter transceiver was out of service due to a bad LM380N. Gratitude is extended for:

1. Not putting the customer through the hassle of a $20 minimum order.
2. Not waiting 4 weeks to see if the customer's personal check clears the bank.
3. Shipping the order on the day of receipt.
4. Not omitting a portion of the order and recommending a reorder in 4 to 6 weeks.

Would you kindly send an additional catalog for the company engineering department catalog file?

May you enjoy much business success.

Yours Truly,
Richard A. Drew, P.E.
Electrical Engineer
Wisconsin Rapids WI

THE BAD . . .

After reading about "The Bad" Trigger Electronics in your August issue, I just had to write to you and tell you of another outfit that seems to operate the same way, 73 Magazine.

On June 9, 1975, I mailed you a check for $4.00 for a DX bearings chart. Some weeks later I found that I did not need this chart and since I had not received it anyway, sent you a letter requesting that you cancel the order and refund my $4.00 which has cleared my bank. I followed up two weeks later with another letter requesting the refund and as of this date have not received either the chart or the refund. Please send the refund and remember that "People who live in glass houses shouldn't throw stones at Trigger Electronics" or something like that. I doubt that this will get into your letters column but maybe it will get my $4.00 back.

Len Malone WB8PTP
Cincinnati OH

Sorry. This confusion and our inability to process your order properly were directly traceable to "summer vacation devastation". We have sent you a check for $4.30 (your $4.00 plus postage for your three letters). — Ed.

AND THE UGLY

I just got my August issue of 73 and the first thing I read was the letters. I was interested in the article, "The Bad . . .", by Scotty Bottom from Worcester MA. In March I ordered the Johnson Viking Match Box for $94.95. I also sent a check for $96.55, to cover all costs. A month later I got the canceled check. My father and I have called Trigger four times. Each time Miss Dolly gave us the run-around. The last time we canceled the order and asked for our money back.

Nothing happened, so we wrote the Chamber of Commerce in River Forest IL. They contacted Trigger. A few days later we got a notice from Miss Dolly saying that we would be soon receiving my money. It has been two weeks and nothing has happened.

We will soon be going to the Post Office to complain of mail fraud.

Wesley J. Larsen WN3ZHT
Frackville PA

Mr. Larsen also submitted photostatic evidence of the bases for his complaint and — unfortunately — every word in his letter appears to be the truth. — Ed.

A BOUQUET

In these days of so many moans and complaints, I think a bouquet is deserved. Your special rate 2000 QSLs have been received. I'm very pleased with the printing and the QSL itself. Thanks for the bargain!

H. Gordon Wightman VE5XU
Regina, Saskatchewan

USEFUL AND CHEAPER

I have been receiving QST for many months now, and have learned absolutely nothing from it. As a beginner in the electronics field, I find that the QST editors bore me with their elaborate technical articles, seeming to have no consideration for the beginner and Novice. The days are few and far between when I can pick up my latest issue of QST and actually understand what I'm reading. I think they are centering around the EE with a college degree, a load of cash in his pocket, and a junk box a mile high. The average ham with a general knowledge of electronics and a modest income doesn't, in my opinion, give a blankety-blank about i-f responses in his double-balanced mixer, or building a converter for Oscar. The interest just isn't there, and you can't force it by constantly printing that type of article. Surely those articles are important and mean a lot to many hams, but they have their place and time. They belong in the publications, but WHY SO @¢—*# MUCH??? I'm sick and tired of reading about docket 20282, the RFI Bill, and the ARRL's beloved National Convention. QST's attitude is going to wipe me off their subscription list . . . and very soon.

If you think I'm an old man of 150 babbling away, you're wrong. I'm a 16 year old Advanced licensee, and I feel we need better articles in our publications — different antenna designs and construction stories, NOT JUST TWO METER FM, but everything else as well. We need more USEFUL and CHEAPER projects to build — good practice for the beginner. And HEY, Mr. GENERAL, Mr. ADVANCED, and Mr. EXTRA CLASS, how about a helping hand to those little Novices and soon-to-be operators over there? Because who's going to operate when you're gone? I think QST has done nothing except make money, and I've had enough of it.

I read our club's 73 magazine today, and I'll be reading theirs no more, since I'll be getting my own subscription soon. I've found 73 to be fascinating, filled with projects and ideas that are a reality to me. Real down-to-earth articles, some with humor. Who says Wayne Green's nuts? I think he's got a good thing going, and he shouldn't give up, no matter what people think. My QST subscription will soon be canceled, and guess who'll get the cash? 73 Magazine!!

Steve Reed KP4EAI/KP4USN
Sabana Seca, Puerto Rico

GOOD GRIEF

Good grief, Wayne, "Don't Feed the Bears," in the August 1975 "73" is too much. I always considered you to be somewhat selective in your choice of articles but one more like that and . . . (*censored*) . . .

Bob Myers K3HWL
Meadville PA

TTL ENLIGHTENMENT

I am not an amateur radio operator, but have been involved in electronics for the past 9½ years, working with missile systems, radars, computer peripheral equipment, commercial radio equipment and data communications. I subscribe to 73 for a number of reasons; the most important one is the practical application of electronic theory with everyday technical problems. I have just read the article titled *The Best Logic Yet* by William E. Browning WB5IRY in the August issue and find that I must comment on what I consider to be some basic flaws in his thoughts on TTL Circuitry.

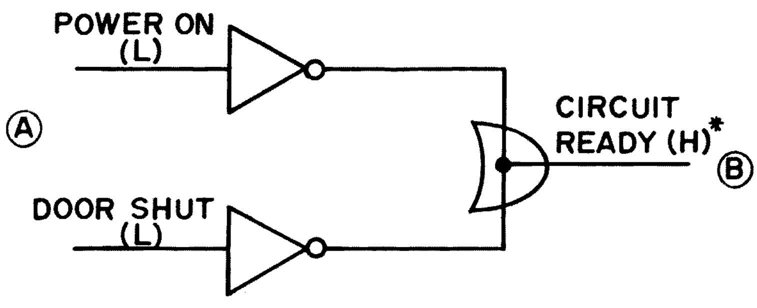
One statement that he made was, "Do not connect two outputs together". This should have read, "Do not connect two outputs together unintentionally," since there are several times that two outputs ARE connected together to perform a certain function such as in "Wired 'OR'" applications (as shown in the accompanying example), as well as in other applications (also shown). I have been involved in using TTL logic for several years and once taught the subject in a commercial school. This logic is indeed easy and probably the "best yet," particularly for the person who has never worked with logic ICs before, as Mr. Browning pointed out in his article.

Future articles should point out the various circuit configurations which are presently being used commercially. (Such a task, though seemingly difficult, is really easy since a book published by the technical magazine *Electronics* is available at a relatively low cost — the title is "Circuit Designer's Casebook". The address of the magazine *Electronics* is: 1221 Avenue of the Americas, New York NY 10020.)

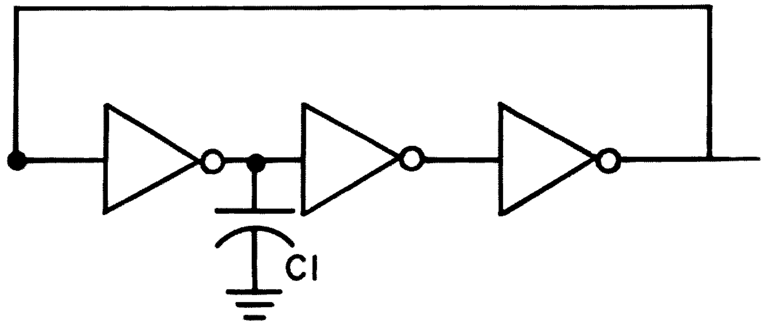
I hope this letter will enlighten some of your readers about TTL logic and its uses.

Roy M. Hein, Jr.
Livonia MI

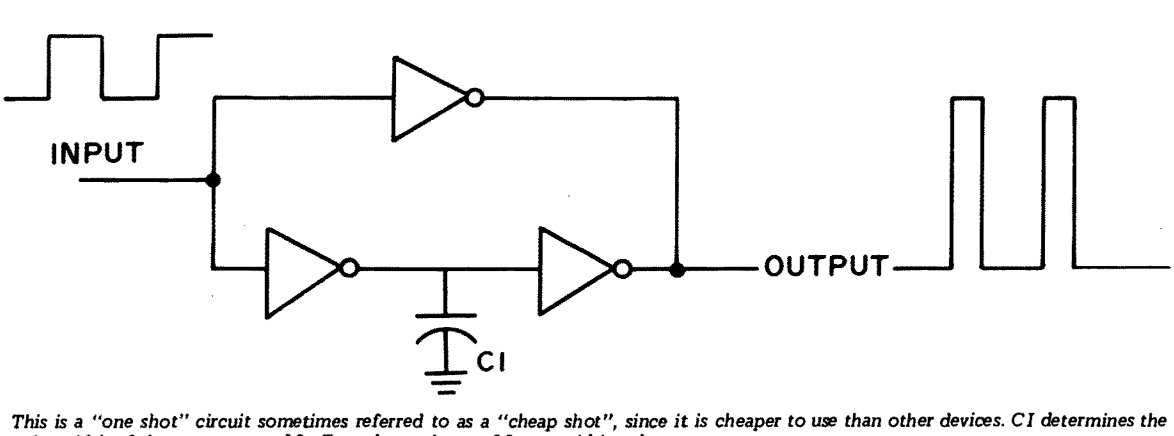
Continued on page 19



*Any high condition at the input (A) will force a low at the output (B). *"( )" indicates signal condition for a "true".*

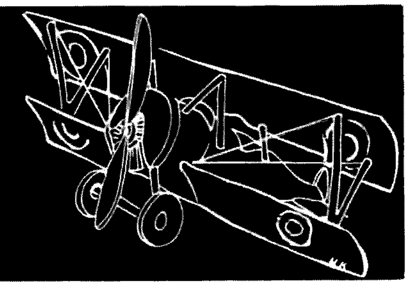


This circuit is a free running multivibrator. The frequency is determined by the value of CI and the IC's internal circuits. It costs about 25¢ to build and I have seen it used from a TC of 1 sec to 1 MHz.



This is a "one shot" circuit sometimes referred to as a "cheap shot", since it is cheaper to use than other devices. CI determines the pulse width of the output, e.g., 10 uF produces about a 10 usec width pulse.

Autobiography of an Ancient Aviator



W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230

$7.50 for 10 Min.

Soon after I had gotten back to Brooklyn from delivering the LWF plane to Hal Bazley in Boston, I heard that Juan Trippe had some boxed Aeromarine 39b seaplanes that he needed help in setting up. They were located in a hangar at the inactivated Naval Air Station at Rockaway, Long Island. I got Art Caperton to join me on a journey to the N.A.S., where we talked with Trippe. He said he wanted to set up one of the ships to survey a possible airline route from the East River at Manhattan to Southampton, Long Island. We agreed to set up a ship for him, if we could set up another for our use in passenger carrying at Port Washington. The 39b was a biplane with a single pontoon under the fuselage and small wingtip pontoons. It was equipped with a Curtiss OXX6 engine that was supposed to put out 100 HP.

It only took us a week to set up the two seaplanes and test them. These ships were not ideally suited for

He owned a dozen pairs of leotards ... which served as his underwear as well as his performing uniform.

making money at passenger hopping. They had only two single seat cockpits, the aft one for the pilot and the forward one for a $7.50 for ten minutes passenger. One week was enough to convince us that we weren't going to have enough money to keep it up. At this juncture we were both fortunate to have other flying jobs offered. Caperton was recruited to fly mail from New Orleans to Pilottown, at the southern tip of the Mississippi delta, in HS2L flying boats. Gillespie, of Heller Field, Newark, N.J., wanted me to fly a Curtiss R4 landplane that he was assembling near Middletown, Pa. We each accepted our offer and I notified Trippe that we were turning his 39b back to him. I flew the ship to a seaplane base at College Point for fueling. Trippe joined me there and flew the ship to Sheepshead Bay, Brooklyn, where I disembarked, and he went on to the N.A.S., Rockaway. A few years later Juan Trippe started Pan American Airways with a flying boat service between Key West, Florida and Havana, Cuba. As almost everyone knows, he built Pan American into one of the largest international airlines in the world.

Although the Naval Air Station had been decommissioned and there were no Navy activities, a maintenance crew and several watchmen were stationed there. Trippe, Caperton, a mechanic and I were lodged in a barracks. It was interesting to see the great number of cases of ------y (your first guess was correct) that were landed there and loaded on trucks for further transport. I got a lift on one of the trucks one night to a place where I could get a subway to Brooklyn. We sailed right through with no interference at all — and only one stop to pay a "toll".

When I arrived at Middletown I found that they had the R4 nearly ready to attach and rig the wings. A 220 HP Hisso engine had been installed and the center section and tail surfaces all rigged. The ship was really an overgrown Jenny with the front cockpit enlarged to accommodate four passengers. The ship was owned by Pat Doyle, who proposed to barnstorm through western Pennsylvania and West Virginia under the name of "Doyle's Flying Circus". He had hired a wing walker and parachute jumper named "Baby Otto Hoover". Hoover was quite a character. He owned about a dozen pairs of leotards of many different colors with contrasting trunks to go with them. These served as his underwear as well as his performing uniform. All he needed was a purple cape and a big red "S" on the front of his leotards to look like Clark Kent.

By September 12th the ship was ready to go. Of course the field where we had done the final assembly was small and completely surrounded by high tension wires, but it was available. That morning, however, there was a good breeze blowing the long way of the field so I took the ship off with no trouble and flew it the few miles to the Air Service Middletown Air Intermediate Depot field. The Commanding Officer of the field came out to greet me personally with orders to "get that crate the h--- off the

Hoover jumped and landed in the middle of the Susquehanna river, surprising the crowd which was expecting him to land in the park.

field". I told him that a few things had to be done to put the ship in flying condition and that the owner and his mechanic would be there soon to make the necessary adjustments. He finally agreed to let us keep the ship there overnight. He even sent some men out to tie it down for the night. My reserve officer's ID card helped, I guess. Doyle and Hoover arrived about an hour later and we rerigged the wings so they didn't flap quite so much. The boys on the gas truck came out after dark and filled our gas tank for a couple of dollars.

Next morning, after a test hop, we piled all our gear, including Hoover's two parachutes, Doyle and Hoover, into the front cockpit, and flew to a field just south of Harrisburg where we could leave the ship for the night. Harrisburg was having some kind of a celebration the next day and Doyle had contracted with the committee to have the plane fly over Riverside Park where they were having the doings, do a few stunts, and put on a wing walking exhibition and a parachute jump. So we did the show and Hoover jumped and landed in the middle of the Susquehanna River in about two feet of water. Embarrassing, as he was supposed to have landed in the park. His chute was very large, so it gave him time to perform on its attached trapeze on the way down.

A couple of days later we got to Hanover, where they were having a carnival. We stayed there four days and did quite well carrying four passengers at $7.50 each on about 25 flights a day.

Pat Doyle had made advance arrangements for a performance of

our show and several days of passenger-carrying at Elkins, W. Va. We arrived there safely on the afternoon of September 11th and landed on a hillside meadow on Dice Harper's farm.

I learned a few things about Pennsylvania mountain flying on that trip. First of all, the R4 loaded down with the three of us and all our gear did not have a ceiling high enough to get us over some of the higher ridges.

I learned a lot about bouncing over fences on short field takeoffs.

So when we came to a high ridge we would have to fly alongside it until we either found an updraft that would take us over or a pass we could get through. We did quite a bit of wandering up and down valleys.

We based in Elkins for about three weeks, making side trips to several nearby towns to put on shows at $200 each with $50 more for a parachute jump. We also did quite a lot of passenger carrying from small local fields. I learned a lot about bouncing over fences on short field trakeoffs and landings, and also about hillside operations. I had to be my own mechanic, too.

Next month — the R4's curtain call and more LWF flying, including a lucky close one. So don't be so uptight about life. No one ever got out of it alive.

AZ-EL PROGRAM

A program, written for the Hewlett-Packard programmable calculator (HP-65) is available for computing both azimuthal and elevation coordinates (az/el) for tracking either Oscar 6 or 7. Once the satellite orbital data and individual QTH positional coordinates are inputted and stored, the routine will compute az/el antenna pointing coordinates for any number of arbitrary, specified times following the ascending node. Az/el coordinates computed with this routine for both ascending and descending passes agree favorably with both the results of a FORTRAN program run on a CDC-3800 computer and with actual observed satellite trajectories. The program can be stored on a single HP-65 magnetic card. Documented copies of the program will be forwarded upon request and receipt of an SASE; if a blank magnetic card is included with the request, a copy of the program itself will be sent.

Earl F. Skelton WA3THD
1901 Deerfield Court
Washington DC 20021

Oscar 6 Orbital Information				Oscar 7 Orbital Information				
Orbit	Date (Oct)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (Oct)	Time (GMT)	Longitude of Eq. Crossing °W
13529	1	0151.5	78.7	BX	4001	1	0115.9	68.8
13541	2	0051.4	63.7	A	4013	2	0015.3	53.7
13554	3	0146.3	77.4	B	4026	3	0109.6	67.2
13566	4	0046.3	62.4	A	4038	4	0008.9	52.1
13579	5	0141.2	76.1	B	4051	5	0103.2	65.6
13591	6	0041.1	61.1	A	4063	6	0002.5	50.5
13604	7	0136.0	74.9	B	4076	7	0056.8	64.0
13616	8	0036.0	59.9	AX	4089	8	0151.1	77.6
13629	9	0130.9	73.6	B	4101	9	0050.4	62.4
13641	10	0030.8	58.6	A	4114	10	0144.7	76.0
13654	11	0125.8	72.3	B	4126	11	0044.1	60.8
13666	12	0025.7	57.3	A	4139	12	0138.4	74.4
13679	13	0120.6	71.0	B	4151	13	0037.7	59.3
13691	14	0020.6	56.0	A	4164	14	0132.0	72.8
13704	15	0115.5	69.8	BX	4176	15	0031.3	57.7
13716	16	0015.4	54.8	A	4189	16	0125.6	71.2
13729	17	0110.4	68.5	B	4201	17	0024.9	56.1
13741	18	0010.3	53.5	A	4214	18	0119.2	69.6
13754	19	0105.2	67.2	B	4226	19	0018.6	54.5
13766	20	0005.2	52.2	A	4239	20	0112.9	68.0
13779	21	0100.1	65.9	B	4251	21	0012.2	52.9
13791	22	0000.0	50.9	AX	4264	22	0106.5	66.4
13804	23	0055.0	64.7	B	4276	23	0005.8	51.3
13817	24	0149.9	78.4	A	4289	24	0100.1	64.9
13829	25	0049.8	63.4	B	4302	25	0154.4	78.4
13842	26	0144.8	77.1	A	4314	26	0053.7	63.3
13854	27	0044.7	62.1	B	4327	27	0148.0	76.8
13867	28	0139.6	75.9	A	4339	28	0047.4	61.7
13879	29	0039.6	60.8	BX	4352	29	0141.6	75.2
13892	30	0134.5	74.6	A	4364	30	0041.0	60.1
13904	31	0034.4	59.6	B	4377	31	0135.3	73.6

AMSAT-OSCAR 6's THIRD BIRTHDAY!

October 15, 1975 marks the third anniversary of the launch of AMSAT-OSCAR 6. One of two long-lifetime spacecraft now in orbit, AMSAT-OSCAR 6 has now exceeded its original one-year lifetime goal by 200%.

To mark the occasion, special bulletins will be transmitted via the AMSAT-OSCAR 6 two-to-ten meter transponder on the evening of Tuesday, October 14 (October 15, GMT). These satellite transmissions can be heard on approximately 29.50 MHz with most HF receivers and antennas. The times of satellite passes that can be heard over most of North America are:

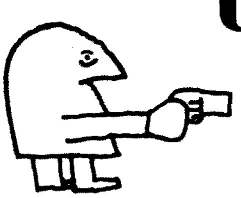
Orbit 13704 — 9:28 pm EDT (± 10 min.), Tuesday evening, Oct. 14 (Oct. 15 GMT);

Orbit 13705 — 8:23 pm PDT (± 10 min.), Tuesday evening, Oct. 14 (Oct. 15 GMT).

An attractive, multi-color AMSAT-OSCAR 6 QSL card is available for stations reporting reception of these transmissions. Give the time, signal strength, and call letters of the bulletin station, describe your receiving equipment, and send this information along with an SASE to "AMSAT-OSCAR 6 Report," P.O. Box 27, Washington DC 20044.

amsat ™

CONTESTS



Editor:
Robert Baker WA1SCX
34 White Pine Drive
Littleton MA 01460

RTTY ART CONTEST
Starts: October 1
Ends: November 30

All worldwide licensed radio amateurs and members of their immediate families (except officials and judges of this contest and members of their families) are eligible to participate in this contest. Entries must have been originated by means of manual inputs to a teleprinter using a standard communications keyboard, and may be submitted only by the originator of the art, or by the amateur on behalf of a family member. Submitted art may be of any subject suitable for transmission via amateur radio. Entrants may submit as many entries as desired, and each entry shall be given a short title. Submitted art may contain overline shading. Tapes of entries shall be formatted to permit a reasonably short running time, and to be compatible with machines which do and do not downshift on space. Compatibility with machines which interchange the bell and apostrophe is not required. At least three functions must be used between each line, normally: CR, LF, LTRS. Each line of the art shall be limited to a maximum of 72 characters (including spaces) and tapes to a maximum running time of 40 minutes at 60 wpm for the art itself, exclusive of any other information on the tape.

Each entry must have been transmitted for the first time via amateur radio after October 1st and must be accompanied by a confirmation of at least one receipt of its transmission, identifying the title of the art and the call letters of the receiving and transmitting stations. All confirmations must be in writing (not by RTTY transmission), and must have been obtained by the entrant from the receiving station. Entrants may obtain necessary transmission of their entry by any amateur radio station. The tape and prints of each entry shall carry the full name of the author, call letters of the submitting station, and mailing address. This information shall be both written upon a beginning leader of the tape and also punched in the tape to appear on page copy when reproduced. Entrants must submit one five-level paper tape and five prints of each entry and by such submission agree that the tapes and prints may be used, duplicated and published for any purpose.

AWARDS:

Entries will be judged on the originality of the author in selection of subject matter, on excellence of technique in producing the art and formatting the tape, on overall appearance of the art when viewed from a distance, on suitability for publication, and on the entrant's compliance with these rules. A committee of judges, made up from individuals who have exhibited an interest in RTTY art, will select first, second, third and honorable mention winners. Winning entrants will receive a plaque for first place and certificates for other places. Winning entries will be published in the RTTY Journal and other amateur radio magazines. The decisions of the judges shall be final.

ENTRIES:

Tape, prints and transmission confirmation information should be securely packaged and sent to: RTTY Art Contest, c/o Don Royer WA6PIR, 16387 Mandalay Drive, Encino CA 91316 USA. Entries must be postmarked prior to December 1, 1975. Entries will not be acknowledged nor returned. Winners will be announced as soon as possible after the closing date.

Note: Since mail damaged tape will be of little value, it is suggested that tapes be wound tightly upon a hard core.

VK/ZL/OCEANIA DX CONTEST
PHONE
Starts: 1000 GMT Saturday, October 4
Ends: 1000 GMT Sunday, October 5
CW
Starts: 1000 GMT Saturday, October 11
Ends: 1000 GMT Sunday, October 12

WIA and NZART invite all amateurs to participate in the 1975 VK/ZL/Oceania DX Contest in which the rest of the world contacts stations in Oceania but with emphasis on ZL and VK.

EXCHANGE:

The exchange will consist of five or six figures made up of the RS(T) report plus three figures which should start with ØØ1 and increase by one for each successive QSO.

SCORING:

For Oceania stations (other than VK/ZL) score 2 points for each QSO on a specific band with VK/ZL and 1 point for each QSO on a specific band with the rest of the world. For the rest of the world (other than VK/ZL) score 2 points for each QSO on a specific band with VK/ZL and 1 point for each QSO on a specific band with Oceania stations other than VK/ZL.

FINAL SCORE:

Multiply the total QSO points by the sum of VK/ZL call areas worked on all bands. The same VK/ZL call area worked on different bands counts as separate multipliers.

AWARDS:

Attractive colored certificates will be awarded to each country (call area in USA, Japan and USSR) on the following basis: top scorer using all bands, separate awards for phone and for CW.

SWL SECTION:

To count for points, a VK or a ZL station ONLY must be heard in a QSO and the following details noted in the log: date, time (in GMT), call of the VK or ZL station heard, callsign of the station he is working, RS(T) of the VK/ZL station heard, serial number sent by the VK/ZL station heard, band and points. Scoring is on the same basis as for the transmitting section and the Summary Sheet should be similarly set out.

LOGS:

Logs must show, in this order: date and time in GMT, call of station contacted, band, serial number sent, serial number received. Underline each new VK/ZL call area contacted and make separate logs for each band used. A Summary Sheet must be included, showing: callsign, name and address (use block letters please), details of equipment used, and for EACH BAND, QSO points for that band and total of VK/ZL call areas worked on that band. All band score will be total QSO points multiplied by sum of VK/ZL call areas on all bands while single band scores will be that band's QSO points multiplied by

VK/ZL call areas worked on that band. Also, sign a declaration that all rules and regulations have been observed. All logs should be posted to reach the contest manager before 31 January 1976. Send all logs to: VK/ZL Contest Manager, WIA, GPO Box 1002, Perth, West Australia 6001. All logs are greatly appreciated!

YL ANNIVERSARY PARTY

CW
Starts: 1800 GMT Wednesday, October 15
Ends: 1800 GMT Thursday, October 16

PHONE
Starts: 1800 GMT Thursday, November 6
Ends: 1800 GMT Friday, November 7

All licensed women operators throughout the world are invited to participate. YLRL members only are eligible for the cup awards. Non-members will receive certificates. Only YLRL members are eligible for the Corcoran Award. Contacts with OMs do not count. All bands may be used but cross-band operation is not permitted. Only one contact with each station will be counted in each contest. General call will be "CQ YL".

EXCHANGE:
QSO Number, RS(T), ARRL section or country.

SCORING:
CW and phone will be scored as separate contests. Submit separate logs for each contest. All YLs located within an ARRL section, score one point for each QSO with another station located within an ARRL section. Score two points for each contact with a station not located within an ARRL section. All stations not located within an ARRL section shall score two points for each contact with a station located in an ARRL section. Score one point for each contact with another station not located within an ARRL section. Section lists are available from WA6ISY; please send an SASE. Multiply the number of contact points by the total number of different ARRL sections and/or countries worked. Stations running 150 Watts input or less on CW may multiply their score by 1.25. SSB stations running 350 Watts PEP or less at all times may multiply their score by 1.25.

AWARDS:
GOLD CUP – to highest CW YLRL member, anywhere in the world. GOLD CUP – to highest phone YLRL member, anywhere in the world. Certificates will be awarded to the first, second and third place CW and phone score (not combined) and the highest CW and phone log in each district and country. CORCORAN AWARD will be awarded to the highest combined CW and phone score for a YLRL member within an ARRL district. The highest combined CW and phone score from North and Central America will receive a YLAP Hager Plaque (YLRL member only). Another YLAP Hager Plaque will be awarded to the highest combined score from any other part of the world from a YLRL member.

LOGS:
No logs will be returned. Entries in logs must show time, band, date, transmitter power and must be signed. Remember to send separate logs for CW and phone contests. Show claimed score and please check logs. Make sure they have QSO numbers, power and show ARRL section or country to qualify for awards. All logs must be postmarked not later than November 24, 1975, and be received no later than December 19, 1975. Mail logs to: Mrs. Myrtle Cunningham WA6ISY, 1105 E. Acacia Avenue, El Segundo CA 90245.

MANITOBA QSO PARTY

Starts: 0001 GMT Sunday, October 19
Ends: 0300 GMT Monday, October 20

The second Manitoba QSO Party is sponsored by the Amateur Radio Clubs of Manitoba. The same station may be worked on each band and mode. VE4 to VE4 contacts are permitted. Two meter simplex contacts are also permitted.

EXCHANGE:
QSO Number, RS(T), Name & QTH.

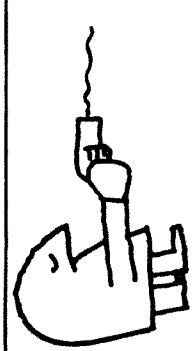
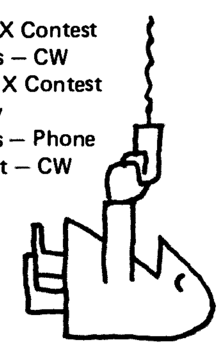
SCORING:
Each contact counts 1 point. VE4s multiply the number of contacts by the number of USA states, VE provinces, and DX countries worked. All others multiply the number of contacts made by the number of Manitoba cities and towns worked.

FREQUENCIES:
SSB – 3770, 3905, 7195, 7230, 14190, 14285, 21245, 21355, 28600.
CW – 3705, 7105, 14065, 21205, 28205.

AWARDS:
Certificates for the highest scoring station in each province, state and DX country. Plaques for the highest scoring VE4 station and out of province station. Additional plaques will be supplied if warranted.

CONTEST CALENDAR

Oct 1 – Nov 30	RTTY ART Contest *
Oct 4 – 5	California QSO Party *
Oct 4 – 5	Rocky Mountain QSO Party *
Oct 4 – 5	VK/ZL/Oceania – Phone
Oct 4 – 5	CARTG RTTY SS
Oct 11 – 12	CD Party – Phone
Oct 11 – 12	VK/ZL/Oceania – CW
Oct 15 – 16	YL Anniversary Party – CW
Oct 18 – 19	CD Party – CW
Oct 19 – 20	Manitoba QSO Party
Oct 25 – 26	CQ WW DX Phone Contest
Nov 1 – 3	North Carolina QSO Party
Nov 6 – 7	YL Anniversary Party – Phone
Nov 7 – 10	IARS/CHC/FHC/SWL-CHC/HTH QSO Party
Nov 8 – 9	European RTTY DX Contest
Nov 8 – 9	ARRL Sweepstakes – CW
Nov 9	International OK DX Contest
Nov 15 – 16	Missouri QSO Party
Nov 22 – 23	ARRL Sweepstakes – Phone
Nov 29 – 30	CQ WW DX Contest – CW
Dec 6 – 7	160 Meter Contest
Dec 6 – 7	TOPS CW Contest
Dec 13 – 14	10 Meter Contest
Dec 31	Straight Key Night

* = described in previous issue.

LOGS:
Send log data and signed declaration no later than November 10, 1975 to: Doug Bowles VE4QZ, 1104 First Street, Brandon, Manitoba, Canada R7A 2Y4.
Note: Last year only 8 logs were sent in and 4 trophies were awarded. If more activity is not shown this year the contest will be dropped, so send in your logs if you work the contest at all.

NORTH CAROLINA QSO PARTY
Starts: 1900 GMT Saturday, November 1
Ends: 0100 GMT Monday, November 3

All amateurs are invited to participate in the 1975 NC QSO Party sponsored by the Alamance Amateur Radio Club.
EXCHANGE:
NC stations send RS(T) and NC county. All others send RS(T) and state, province or country.
FREQUENCIES:
CW: 3560, 7060, 14060, 21060, 28060.
SSB: 3900, 7270, 14290, 21390, 28590.
NOVICE: 3720, 7120, 21120, 28120.
SCORING:
NC stations count one point for each contact. Final score is total number of contacts times total number of states, provinces and countries. NC mobiles use number of counties operated from for additional multiplier. All others count one point for each NC contact. The same station worked on different band, mode or in different NC county counts as new contact. Final score is total number of contacts times total number of NC counties worked.
AWARDS:
Trophies will be awarded to the highest scoring NC station and out-of-state station. Certificates will be issued to the highest scoring stations in each state, province and foreign country as well as each NC county. A certificate will also be issued to the highest scoring NC mobile station. The NC Counties Award Certificate will be issued to any station participating in the QSO Party whose log verifies his contacting 30 or more NC counties during the Party time period, and has not previously been issued such a certificate by AARC, Inc.
LOGS:
Logs must indicate clearly: signal report, band, mode, GMT, state, province, country or NC county. Logs will not be returned. On a separate sheet, please list the following: your name, callsign and mailing address; your total score; county, state, province, country from which you operated; callsigns of operators. Logs should be signed and mailed no later than December 12, 1975 to Alamance Amateur Radio Club, Inc., 2822 Westchester Drive, Burlington NC 27215. SASE will be greatly appreciated.

RESULTS OF THE 1975 B.A.R.T.G. RTTY CONTEST

Single Operator (top 8 places of 86):

#	Call	Points	#QSOs	Countries
1	I1PYS	221,998	191	33
2	W3EKT	219,520	200	32
3	KZ5BH	197,100	174	23
4	I5GZS	180,164	152	28
5	I8AA	178,596	177	31
6	CT1EQ	170,180	180	27
7	15WT	169,186	157	29
8	IT9ZWS	156,720	154	25

Multi-Operator Stations (top 3 places of 7):

#	Call	Points	# QSOs	Countries
1	DLØTD	180,310	194	28
2	HA5KBM	148,428	142	29
3	SK5AA	94,072	121	21

Short Wave Listener Section (top 3 places of 10):

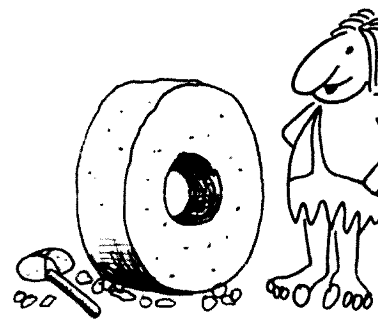
#	SWL Call	Name	Points	# QSOs	Countries
1	K1LPS/18	Larry Filby	163,150	155	29
2	DL-SWL	Wolfgang Geller	152,640	148	29
3	I3 130Ø18	R. Giarnello	150,600	151	38

IARS/CHC, FHC, SWL-CHC, HTH QSO PARTY
Starts: 2300 GMT Friday, November 7
Ends: 0000 GMT Monday, November 10

An SASE to K6BX will bring more detailed information. Contest is open to all amateurs and SWLs worldwide. Same station may be worked on each band and mode, SSB and AM are different modes.
EXCHANGE:
QSO Nr., RS(T), name, CHC/FHC Nr., US state and county or similar division. Non-members send "HTH" instead of CHC/FHC nr.
SCORING:
For CHC — 1 point per QSO with other CHCers, 2 points if HTHer, and 1 additional point if YL, B/P, FHC, Novice, CHC-200, Merit or Club station, or if on VHF/UHF. Double above points if QSO is out of own country. For HTH — contacts with other HTHers count 1 point, with CHCers count 3 points. Rest same as above. For SWL — use same as above depending on whether CHC or not.
MULTIPLIERS:
Each different continent, country, ITU zone and US state (counted only once).
FINAL SCORE:
Multiplier times total points is final score. Multi-operator stations divide score by number of operators.
FREQUENCIES (for US and DX as allowed):
CW: 3575, 3710, 7070, 7125, 14075, 21075, 21090, 21140, 28090, 28125.
Phone: 3770, 3775, 3790, 3943, 3960, 7070, 7090, 7210, 7260, 7275, 14320, 14340, 21360, 21440, 28620, 50.1-50.5, 145-147.
AWARDS:
Hundreds of certificates and trophies in all categories and divisions are awarded. An SASE will bring further information. Send all requests and logs to: International Amateur Radio Society K6BX, PO Box 385, Bonita CA 92002. Logs should be mailed within 15 days after the close of the QSO Party.

Continued on page 142

NEW PRODUCTS



KLM's ECHO II

Well, the ECHO II has finally arrived! KLM Electronics, long known for its line of VHF log periodic fed antennas and FM power amplifiers, is finally filling the gap left when Gonset quit making the Sidewinder.

The ECHO II, known as the LINER II in Japan, has seen wide use in JA-land. Over 10,000 units have been sold in the past few years there. While one or two other firms have begun making SSB rigs, none are priced as low as the moderately priced ECHO II.

Single sideband has become popular in Japan for several reasons. Their two meter band covers only two megahertz (144-146) and no repeaters are allowed. Many VHF operators hold the special Japanese *no code* ticket which is limited to 10 Watts output. Certainly the narrow bandwidth of SSB helps keep down QRM under these conditions, and sideband greatly extends the useful range of a 10 Watt transmitter as well. SSB consistently gives twice the simplex range of FM, often more!

Aside from the range advantage and smaller occupied bandwidth required, a 3 kHz sideband signal is not affected by multipath distortion nearly as much as FM. I have used both SSB and FM while mobile in the Santa Cruz Mountains and I find that there are numerous areas where FM modulation is completely wiped out by multipath and phase distortion. While sideband shows obvious signs of multipath, the modulation remains "Q-5" in these same locations. In fact, I am able to maintain communication throughout the mountains where FM yields only marginal communication through a repeater located in the same area!

Of course, the Japanese are not the only ones feeling a frequency bind on two meters! Since every repeater in this country takes up at least 30 kHz *even with channel splits*, many areas are really feeling the pinch. In fact, *even with channel splitting* the typical repeater takes up *45 kHz*, since each also requires a UHF control link. *That's nearly as much spectrum for one FM repeater as the entire bandpass required for Oscar 7!* Eight sideband stations could get lost in that much space, and ten could easily fit.

I think that the ECHO II has come along at just the right moment. It's time we start to think about conservation of the two meter spectrum. With the extended range offered by SSB, repeaters are not required for most point-to-point communications. For mobiles, a sideband repeater is not beyond the possibilities and *could* give even better range than FM repeaters, if the performance of the Oscar satellites is any example!

I've used the ECHO II for more than a year. I've derived a great deal of pleasure from the little machine.

I've heard Los Angeles on several occasions (320 miles), worked Sacramento twice (125 miles), and regularly work most active stations within a 60 mile radius in spite of the mountains. I've worked mobiles as far as 60 miles and I've heard high powered mobiles (140 Watts) as far as 125 miles. My best mobile-to-mobile contact has been Watsonville to San Jose, some 43 miles! I've done this with both the barefoot 10 Watt rig and easily with the 140 Watt linear.

The ECHO II has the following features: AGC, ALC, VXO, RIT, squelch, noise blanker, "Crystal-Plexed" synthesizer, "S"/RFO meter, semi break-in CW, and an external speaker jack.

ECHO II Specs

Sensitivity: 0.5 uV/10 dB (0.18 uV typical)*
Selectivity: 2.4 kHz @ –6 dB
Frequency: 145.0–145.23 & 145.77–146.0 MHz supplied
Output Power: 10 Watts PEP
Audio Output: 2.5 Watts
AGC: 1 uV–1,000 uV/15 dB af (0.1 uV-1,000 uV modified)
ALC: 3 dB rf change with 13 dB audio change above the level giving 5 Watts PEP
Features: Squelch, VXO, RIT, "S"/RFO meter, ALC, AGC, CW (semi break-in), noise blanker, all solid state
Power Req'd: 11 16 V dc @ 3 A (transmit)
Size: 2.5 x 8.5 x 9.75 inches
Price: $399.00. $499.00 with 70 Watt linear and 9 element antenna. $579.00 with 140 W linear and 14 element antenna. (Omni-directional horizontal polarity mobile antenna available soon.)
**Measured with Singer 6201 Generator and HP 331 Distortion Analyzer. Typical value of three units the author has tested for other people.*

I have found the 10 kHz channel steps to be a valuable aid when mobile. It eliminates the need to look at the dial to change frequency. If you know where you are in the band, just count 10 kHz for each step until you get where you want to be!

Setting up skeds on a given frequency is simplified, too. Since the 10 kHz steps vary no more than 100 Hz from channel to channel, accurate monitoring of an agreed on frequency is assured.

The VXO allows ±5 kHz deviation from the center of each channel while the RIT varies *only* the receiver to allow fine tuning off frequency stations (±1.5 kHz). This latter feature is especially appreciated during roundtable QSOs.

I find the squelch invaluable to my type of operation. I like to monitor our local calling frequency while going about my other business, but I don't like to listen to receiver noise while doing so. With the ECHO II, I just squelch it up and forget it until someone calls!

The noise blanker is helpful, too. FM, of course, features built-in limiting, not a feature of SSB. However, the ECHO II's noise blanker, in conjunction with its squelch, gives much the same effect. Though FM is better (at least, quieter) with strong signals, SSB certainly has it beat when signals are weak!

This particular noise blanker is quite effective considering its simplicity. It takes the ignition noise of my VW bus completely out of the picture. Its only drawback, common to simple blankers, is a tendency to crossmod when strong, nearby signals are present. Turning the blanker off cures this, of course.

The AGC works quite well above the 1 uV level. It is not very effective below 0.5 uV, however. This can be annoying when working both weak DX signals and strong locals. My solution was to add an extra PNP complementary amplifier in the AGC i-f circuit. Now my unit compresses 0.1-1,000 uV into less than 12 dB of audio change. I can send details to anyone interested who sends me a self-addressed stamped envelope.

I've had opportunity at work to put the ECHO II through its paces on an HP spectrum analyzer. Third order distortion products are about 20 dB below each tone of a two-tone test signal (-26 dB according to ARRL standards). In using the unit with the KLM 10-140BL amplifier, I like to drop the power back to 8 WPEP, and at this level the ECHO II shows only -26 dB third order products (-32 dB ARRL). I did not check the 10-140.

Spurious output and harmonics are all better than 55 dB down. Most are better than 60 dB.

ALC is very effective. A 13 dB change in audio input above the level that gives 5 Watts PEP is compressed to an rf output change of only 3 dB. This keeps the average modulation up where it belongs.

Finally, the ECHO II is *the* rig for the experimenter. As I mentioned, I modified the AGC to be more to my liking. I've also added lower sideband for reception of Oscar 7, AM carrier insertion, sidetone and an rf gain control. My current project is a low noise preamp (under 2 dB).

Other projects could be an upconverter from 10 meters to make the ECHO a self-contained Oscar station, transverters to other bands (such as 220 MHz where that noise blanker would really help!), or an external vfo. I've made numerous Oscar contacts with the unit, so I'm sure the first project is practical. I'm working on the second one and the third should be easy.

There is plenty of room to work in the ECHO II. Unlike older two meter rigs (especially the Sidewinder), this unit is *not* built from the inside out. Everything is readily accessible on PC boards.

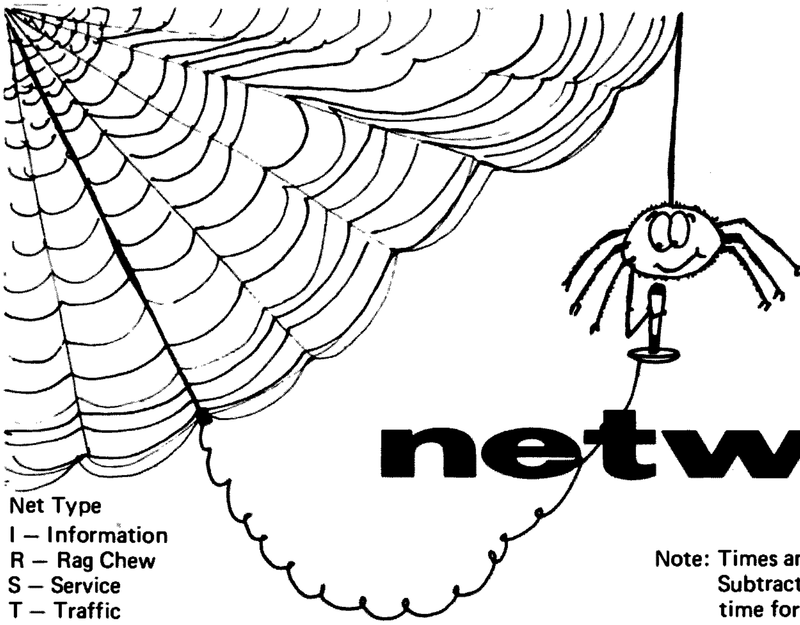
Two meter sideband is flourishing throughout the rest of the ham world. In the US it is just now beginning to get started in a big way. Unlike FM, which received a huge boost when surplus commercial rigs hit the market at ridiculously low prices, SSB is having to make it on its own merits. But when stations in San Jose and Santa Cruz consistently work stations 320 miles down the mountainous length of California *without repeaters*, that gives some of us plenty of incentive to get going! The other opportunities include long-haul tropo, increased mobile simplex distance, and just the fun of roundtables over 60-80 mile paths with no QRM. For the more daring, there is Moonbounce. For the operator with a sense of adventure, there is Oscar. The ECHO II is a great way to start!

... James Eagleson WB6JNN/6
118 Sunnyside Ave
Santa Cruz CA 95062

MORE New Products on page 146

E. H. Barnett WBØIIX
Route 1
Ashland, Missouri 65010

You can only get out of amateur radio what you are willing to give. Check into a net. You will make new friends who will be there when you need them! (Ever tried to raise a tower by yourself??) If you don't want to wait for a long roll call, most nets have a "Short Timer's" check-in before roll call. If you do check into a net, tell me about it so I can include it here.



networks

Net Type
I — Information
R — Rag Chew
S — Service
T — Traffic

Note: Times and Days are given in GMT. Subtract one hour for nets changing time for Daylight Savings Time.

Service Area	*Net Type*	*Name*	*Time*	*Days*	*Freq*	*Mode*
NATIONWIDE						
U.S.	I	DX Broadcast	0300	Thurs.	14265	USB
U.S.	S	County Hunters	1500	Sat.	14335	USB
U.S.	T	Coast Guard Net	1700	Mon-Fri	14313	USB
Canada	T	Trans Canada Net	1800	Sat.	14130	USB
REGIONAL						
U.S.	T	75M Interstate SBN	0100	Daily	3985	LSB
South Central U.S.	T	7290 Net	1800	Mon-Fri	7290	LSB
W1	T	First Regional Daytime	2100	Daily	3930	LSB
W3	T	Third Regional Daytime	2115	Daily	3195	LSB
W2	T	Second Regional Daytime	2130	Daily	3930	LSB
W4	T	Fourth Regional Daytime	2200	Mon-Wed-Fri	7233	LSB
STATEWIDE						
NY	T	New York RTTY Net	0030	Daily	3613	FSK
W MASS	T	West Mass. Emergency Net	1230	Sun.	3935	LSB
CONN	S	Connecticut Phone Net	1500	Sun.	3965	LSB
VT	T	Vermont SBN	2200	Mon-Sat	3909	LSB
MAINE	S	Sea Gull Net	2200	Mon-Sat	3940	LSB
NY	T	N.Y. City-Long Island Phone Net	2230	Daily	3928	LSB
NY	T	N.Y. State Phone Traffic & Emergency Net	2300	Daily	3925	LSB
NH	T	Granite State Net	2300	Sun.	3945	LSB
CONN	S	Connecticut Phone Net	2300	Mon-Sat	3965	LSB
RI	T	Rhode Island Slow	2330	Wed-Sun	3715	CW

* *

A 90 year old lady wandered from a nursing home in Sterling, Ill. on the afternoon of July 12, 1975. At 5:30 pm, the Whiteside County Civil Defense Director, Kenneth Murphy, put out the call for all available RACES members to respond with communications equipment to help in the search for the elderly lady.

Under the direction of WA9NXE and K9ZIL, coordination with the county sheriff and ILL SP was set up. Groups equipped with portable 2 meter radios were sent out on foot to cover all vacant lots, wooded areas, cornfields and several used car lots in the area next to the nursing home. A steady drizzle of rain didn't hinder the search operations. As darkness closed in, the search was halted at 9 pm with the elderly lady still missing — as the temperature dropped to 50 degrees with rain.

The search resumed again the next morning at 8 am. The same areas were again covered by volunteers on foot with portable 2 meter radios. At approximately 11 am, the long awaited signal was flashed over the 2 meter network by K9APD that the little old lady had been found and her condition was A-OK — but send an ambulance. The little old lady had wandered into a tall cornfield, found a grassy area and, apparently confused and lost, bedded down for the night.

Those who assisted WA9NXE and K9ZIL were K9BEF, K9HOJ, WB9MCZ, K9SFU, K9APD, W9CSP, WA9BSO, WB9DNA and WA9ARR. The Sterling repeater WR9AER also assisted in the rescue.

. . . Whiteside County IL RACES

MORE LETTERS

RE-SHOOTING THE SATELLABE

I have received several letters in reference to my article in June entitled, "Shoot Oscar with a Satellabe". Practically all letters end with, "Where did you get the polar projection map of the northern hemisphere?" I would like to inform the readers that I also had difficulties in finding such a map of needed dimensions. I finally found one in Callbook's "Ham Atlas" that was just the right size. I simply traced it on a piece of mylar and used it for the satellabe.

Due to some misregistration of the multiple "burns" of Figs. 3 and 4, the satellite track does not originate at the equator, where it should, but starts at about 5° northern latitude. This fact makes tables, describing the instantenous position of the satellite, about 1.5 minutes off. Readers should take this under consideration if they want to check the claimed accuracy of the device. Fig. 5 is also slightly misregistered.

K. J. Deskur K2ZRO

Sorry about the misregistration, and thanks again for a great article — Ed.

INFLATION HZ

Everyone knows inflation is bad. I never knew exactly what caused inflation, but my buddy Casey Jones (or should that be KiloHz Jones) says it's a vicious Hz, like a cat chasing its tail, ya know.

I've always wanted one of those solid state transceivers that run on 12 V no-Hz power (dc to you non-Hz'ians). I decided that, if I put my gas guzzler up for a dozen lunar Hz and got one of those little cars with a 2 Hz engine and re-Hz'd some paper and beer cans, I might save enough to get some new gear.

As I started out the door to hop on my motor Hz, I tripped over the jr op's triHz and fell on my face. That really Hz like HI! My motorHz wouldn't start, so I got the XYL's biHz, but both tires were flat.

So I had to call "Hz-Renta-BiHz" (they don't try as hard as that other outfit). I buzzed down and picked up the little gem xcvr and took it home, hooked it to the no-Hz supply and tuned across the many Hz. Down on 29 MHz, I heard a weak sig with plenty 60 Hz on it signing HZ1HZ. I called and called but N.D. I had forgotten the sunspot Hz was at its lowest spot.

Well, u can't win 'em all.

Russell Robinson W4UD
Bristol TN

Our staff holds varied opinions about what prompted this missive. — Ed.

KAHANER'S CLIQUE

Really enjoyed WB2NEL's article on TTLs. Looking for more of the same in the future, I hope.

Dale Sewell WB4JHQ
Pensacola FL

I found Larry Kahaner's (WB2NEL) article very helpful. Please have him write another. I'm especially curious about op amps.

Fred M. Haas W6TXE
Los Angeles CA

I would request urgently that you keep up this talk on ICs and repeat, repeat — I have much difficulty understanding.

Jim Sullivan W1PSW
Woburn MA

I read the article by Larry Kahaner WB2NEL about *How Gates Work — A TTL Primer.* I found it very interesting and hope to see more of the same. Many thanks.

Jim Finnell W6DEU
San Jose CA

We liked your July issue very much — especially the article on page 113 by WB2NEL regarding *How Gates Work.* This is just what I was looking for. Keep up the good work.

Tommy Thompson W6BPV
Santa Cruz CA

Just a quick note between jobs. Great article by Larry Kahaner in July issue (*How Gates Work*). Please talk him into another basic primer on ICs!!

Great magazine, 73!! Keep up the good work. You're far better than the competition!

Jim Washburn WA4FQB
Raleigh NC

RECEPTIONAL OBJECTIVITY

Considering the functional incremental concept of the August issue, coupled with the optional third generation flexibility of its editorial style, I wanted to express my balanced reciprocal capability and say that the integrated transitional options of the issue were outstanding! Editorially speaking I can truly say that you have successfully maximized my receptional objectivity.

John Portune WB6ZCT
Hawthorne CA

Good going, John . . . I'd been betting that not one reader would notice the total meaninglessness of the cover sub-headlines . . . and you caught my little joke . . . Wayne.

COUNT SERBO-CROAT AS TWO

Would you please print the following in the International Intelligence and Correspondence Section of your world-famous magazine?

DL1CU's new edition of "Ham's Interpreter" (just received), which now includes Esperanto, may be purchased from: "Korner, 7016 Gerlingen/Württ., Postfach 9, West Germany."

The price is 5.00 DM and airmail postage is 2.70 DM. Mein Deutschmark Maschine as of today — August 15 — thirty nine cents U.S. per Mark out prints. That means $3.00, or thirty cents a language — twenty seven cents each if you count Serbo-Croat as two. An idiomatic bargain.

Muchisimas gracias to SM7COS, WA1NIZ and WA6ZKI for help in pinning down the above QRA.

While you're printing things — how about more of that good stuff by WB5IRY and K8BFH/1 in the August issue? Thanks much.

Ken Cole W7IDF
Vashon WA

P.S. Perhaps I should mention that all this is in reference to an article in the June issue on page 17.

OVERWHELMED

I note with dismay your reference to a possibility that 73 may change its size sometime. I notice from my complete set of issues that, since its inception, 73 has had one size change (minor) and a change in binding style:

from the stapled edge to the glued edge, which now prevails.

What I have to say is this: If you feel you *have* to copy *QST*, please wait until the end of the year to do it. It will be bad enough having to re-arrange my shelves to accommodate the new size binders. If and when the new size arrives, I hope it will have the stapled binding like *BYTE* has. I see *no* advantage to the glued binding as on *QST*, *PopTronics*, *Radio Electronics*, *73*, etc. (I'll just bet it might be a bit cheaper!)

The first issue of *BYTE* honestly overwhelmed me. I was really expecting a 25-50 pager more like a newsletter. I sincerely hope that issue #1 is just the beginning of better things to come.

Ralph O. Irish WA8GDT
Utica MI

If only QST were going to the large size we would probably stay in our present size, but with the other three changing this means that most of the advertising will be made up in the large size. It is very costly for advertisers to have to design both large and small ads, so the small size would be a serious disadvantage. BYTE *was started out in the large size because most of the advertisers in that field have their ads made up in the large size. Glad you enjoyed* BYTE *— the reaction has been most enthusiastic. We will probably have to go to what is called perfect binding with* BYTE *— this is the style used for 73 — no staple to keep the magazine from opening flat as is used by* QST. *The saddle stitching is nice, but doesn't work well for thicker magazines without special machinery which few printers have — this is the style used by* HR *and* CQ. BYTE *will probably be going to 160 pages soon and this means perfect binding . . . Wayne.*

TRACKING THE HAMBURGLAR

Just a note to you on the list of stolen gear in your latest issue of 73 magazine. Of all the gear listed in the stolen gear column, only the last piece is listed in the FBI NCIC computer. This is the gear that was stolen in Billings, Montana. I feel that you should advise your readers that when gear is stolen they should notify their local police department and supply all model and serial numbers. Request the police to enter this data into the FBI NCIC computer. By doing this, if the gear is recovered by another police department, a quick check through the NCIC will reveal that it is stolen and which police department entered this data.

I'm a ham and also a police officer in the communications section of the Lebanon Police Department, Lebanon, Pa. While reading the 73 magazine I was curious if this data was in the computer. I used our CRT terminal and questioned the NCIC on all the gear listed. Only the last set of gear was in the computer. I thought that you and your readers might be interested.

Ptlmn. Eugene D. Mavretic K3UOX
Lebanon PA

LETTERING SECRET

A lot of home brew projects have been popping up. What surprises me is the lettering on face panels. All of them look professional. The best I can do is a label maker. Can you tell me their secret? Is there an easier way than having it engraved for $25.00 to $30.00?

Harry R. Clement
5804 S.W. 12th
Des Moines IA 50315

WHO'S SANE?

Being one of three known non-ham readers of your rag, I frequently feel like a person visiting in the home of a large but nutty family. Nice people but hard to take in groups of more than one. It is fascinating to follow your opinions of the A.A.A.R.R.L.L., the I.R.S.S., that Walker person and all the nice C.B. freaks. To your credit, you publish a mixture of manure that would fertilize the mind of even the most devout member of the stay-in-a-rut and re-build the twenty-third version of a fifteen transistor BFO type experimenter.

Since by now you are wondering if I propose to make a point or will continue to waste my valuable time, let me assure you that I have just such an intention. Because people in general are basically nosy and are apt to be more so about things that interest them, I believe that the time has come for a feature that depicts Peterborough, N.H., the ultra offices of 73 and, perhaps, some of the saner happy people who bring us our favorite magazine. While all these things are commonplace to you, they represent the outer, exotic fringes of man's quest for the meaning of life to those of us who will never be cast upon your figurative shores. (That one lost me, too. Ibid cir. Frst.)

A final point is that such a series of photos would be a CHEAP feature and anyone who ever had to look at a family album knows that some pretty rotten stuff will still interest those who care. In closing, please send your check for this fantastic idea to:

D. E. Stanfield
3408 Catalina Dr.
Atlanta GA 30341

Fantastic idea — so good that I had already thought of it on my own, no mean accomplishment. Naturally, I have reluctantly had to give the surprisingly large check for this brilliant idea to myself . . . too bad. Put on your thinking cap and try again . . . Wayne.

HOBBY WITHIN A HOBBY

Well, after nearly 5 years as *73* "Lifer #306" (30 Jul 1970), I'd have to call myself a satisfied customer. So, I'm willing to try another of your ventures. I wish you luck and hope *BYTE*, which relates to my hobby within a hobby within a hobby (amateur [radio ≪ data processing ≫ teletype] radio), will be as informative as *73 Mag* has been for me.

Ralph Irish WA8GDT
Utica MI 48087

FEARLED AGAIN

Many of your readers have been getting their DX cards back because of an error in our mailing address. Can you please inform them that the "Far East AUX RADIO LEAGUE" address is: FEARL QSL Bureau, c/o Sam Fleming, GARH-ID-GS-T, APO San Francisco CA 96343.

Thank you for this service.

E. M. Fischer KA2NA/W7IOR
NAF Box 67-44
Atsugi, Japan
FPO Seattle 98767

FATTER, TOO!

Enclosed please find the order form from the August issue and a check for $18.95 for the 5-6-13-20 tape package and one of your Advanced study guides. I've been reading and hearing so many good things about your

tape/study guide combo, that I decided it was time to *upgrade from* Tech. And if what I've been reading and hearing is true, I'm looking forward to being on the low bands by Christmas!

Also, I would just like to tell you that I think you have a pretty good magazine going. I especially enjoyed the TTL logic article in the August issue and would like to see more articles like it. Maybe WB5IRY can be persuaded to write that follow up article on flip flops, decade counters and the more complex ICs. Maybe even a series of articles! Lastly, how about a low band frequency synthesizer that could be used with a crystal controlled xmtr for the low budget ops?

Anyway, keep up the good work. It's really nice to read a ham magazine that has a reasonable blend of theory and practical application written in a straightforward manner. And the mag seems to keep getting fatter too!! When my subscription expires in December, you can bet you'll get a renewal.

Stephen J. Toth K7PZN
Seattle WA

RIGHT AGAIN

I have purchased a MITS Altair 8800 computer and a lot of peripheral equipment from other similar sources. I'm having a ball so far. Tell Wayne he's right again!

Jim Stitt WA8ONQ
Middletown OH

QUITE A TIME

This summer I had quite an experience with ham radio and my company car.

Late in June I was headed south on Highway 99 about three miles north of Madera. As I passed by a car parked on the shoulder, I thought I saw a woman lying in the ditch. I immediately pulled off on the shoulder and ran back. It turned out to be an attempted suicide. A woman had jumped from the car while her husband was driving. She was badly injured and emotionally unstable. Not knowing how badly she was injured, and being afraid to move her, I ran back to my company car, which is equipped with two meters and an autopatch. I phoned directly to the Highway Patrol and asked for help. In eight minutes I had 4 patrol cars and an ambulance on the scene.

After making the call I went back to assist the *woman's* husband, who was having quite a time with his wife. Between the two of us we kept her calm until the ambulance could arrive. She was taken directly to the hospital.

Terry Dunham WA6DPY
Fresno CA
(in correspondence
with WB6BFK)

VERY HAPPY

I recently subscribed to "73" and I am very happy with the articles. More beginners' (Novices') and antenna articles would be nice, although you do a nice job of mixing the articles – both in selection and difficulty.

I would like to ask you a very special favor. I am ex-KN4ACA and W4QDF, *and the bug* has bitten again. As a Novice, I constructed a 15 meter beam made from bamboo poles wrapped in tin foil as described in an issue of CQ magazine. In moving, several times to be exact, all of my old magazines were lost. Our library does not have CQ on microfilm, but could get it on intra-library loan if I could isolate the month and year of this article. I know that you were with CQ during this period, and knowing that this is a terrible imposition, I respectfully request that you please examine your index issues for this article. It should be in the range of 1953-1957.

I thank you very much for this. Best of luck with "73". It's a great magazine. I've stopped both QST and CQ.

Billy P. Edward
Chattanooga TN

Try November, 1955, page 11, "$3.96 Beam" . . . Wayne.

FANTASTIC NEWS

Fantastic news in the mail today. Passed the Advanced and Extra Class exams. All thanks to those study guides and code tapes. All in all, a pair of very good study guides, presenting the theory in a fresh light.

The code tape was also a great help. Copied for ½ to one hour each night for about a month or so. Didn't bother to study or copy the last two nights before the exam – just relaxed.

Once again, thanks for taking the time to put out something that really does help those who need it.

Bill Seibt
FPO Seattle

HP-45 FUN

You may be interested in knowing that Tektronix has discovered that the HP-45 has a timer just like the HP-55. It works like this:

1. Press the "RCL" button.
2. Simultaneously press 3 keys: "7", "8", "CHS". If you have a display like this

00	00	00	00
hr	min	sec	1/100sec

you are now in the timer mode (keep trying – part 2 just takes practice).

To operate the timer:

"CHS" key will start or stop the timer running;

"CLX" will reset the timer to zero;

"EEX" – try it: Any number key will store a "split" while timer is running, or recall a "split" to the display when timer is stopped;

"." causes calculator to leave timer mode.

Find an HP-45 and have fun!

Sig Peterson III
Portland OR

GOING MOD . . . 35

Got your mag today, and I want to give you some advice regarding the sprocket feed Teletype that you want.

DO *NOT* BUY A TELETYPE MOD 33 *SPROCKET FEED!*

GET A MOD 35 INSTEAD.

The Teletype mod 32 & 33 are fine pieces of equipment in their friction feed versions, but when used as a sprocket feed they become quite a headache for all concerned. The owner has to put up with frequent outages and pay for the repairs; the technician has to squint and peer to see the workings, and frequently can't even figure out what is wrong in a short time, so, up go the costs again.

In summary, the mod 33 sprocket feed is subject to excessive down time compared to the venerable 33 friction feed. The money would be well spent buying a mod 35 sprocket feed that will just run and run and run and run and run . . .

My experience stems from seven years as a technician for Western Union Teleg. Co. and not as a result of not understanding the 33 sprocket feed machine – it's just that I feel that the design is poor.

Paul Robertson
Rochester NY

Continued on page 152

Bob Hart K7YGP
622 W. 4th St.
Medford OR 97501

Build a Deluxe TTY Keyboard

Part One

The equipment available to an amateur setting up a RTTY station is usually limited to what is available on the surplus market. While a Model 28 ASR would have been ideal, monetary considerations and convenience dictated a more modest choice for the author: a Kleinschmidt Typing Reperf. Since there was no provision to originate data with the Kleinschmidt, it was decided to construct an electronic TTY keyboard (just for fun). This keyboard started out as just a simple TTY generator but grew to include several handy, if not essential, extra functions. These added functions include a character counter (so you know when to insert a Carriage-Return), automatic Carriage-Return (in case you forget), automatic Letters/Figures shift, and a test generator capable of producing either RY or binary sequential Quick Brown Fox. While the keyboard need not be built with these added functions, they do make operating more enjoyable. Besides, it might even impress your friends.

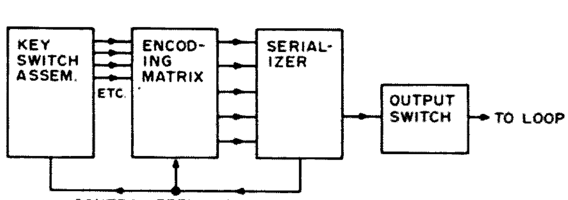


Fig. 1. Simplified block diagram of TTY generator.

The Basic TTY Generator

As with any mechanical keyboard, the function of the TTY generator is to form a seven unit serial code stream at the proper rate, corresponding to a particular symbol, when a key is pressed. The logic used to perform this function is shown in block form in Fig. 1. The key switches connect to an encoder which converts each key closure to a unique parallel binary code. This binary code is then converted, in the next block, to serial form which then drives an output switch. The actual circuitry for the encoder can take several forms but the serializer is easiest to implement as a parallel in/serial out shift register (see Fig. 2).

The seven stage shift register and associated clock and control circuitry are in a standby state when all Q outputs in the shift register are high. This allows the output of U8 to go low which in turn inhibits the clock and forces the output of U9 (output gate) high (Mark). The switches connected to the Reset inputs of each shift register stage, representing the output of an encoder, are closed wherever a Mark signal is required. If, for example, we wish to generate the code for "R," the switches corresponding to the position of Mark pulses in the code stream are closed momentarily. Thus register

stages 3, 5 and 7 are reset while the rest remain in the set (Q high) state. The Q outputs of the reset stages are now low causing U8's output to go high. This high signal does two things: The clock is started and the clamp is removed from the output gate which allows the output to go low, initiating the start pulse (Space). If we are generating 60 wpm (45 Baud) TTY, the first pulse is generated by the clock 22 ms after it receives the go signal. This pulse shifts data in the register one stage downward.

At this point the start pulse ends and the first data pulse begins. Every 22 ms the clock generates another pulse and the data in the register is shifted another increment toward the output. The effect of this is that the output gate sequentially samples the state of each register stage for 22 ms and forms the serial TTY code. After seven pulses from the clock, all register stages are once again in the Q high state. The output of

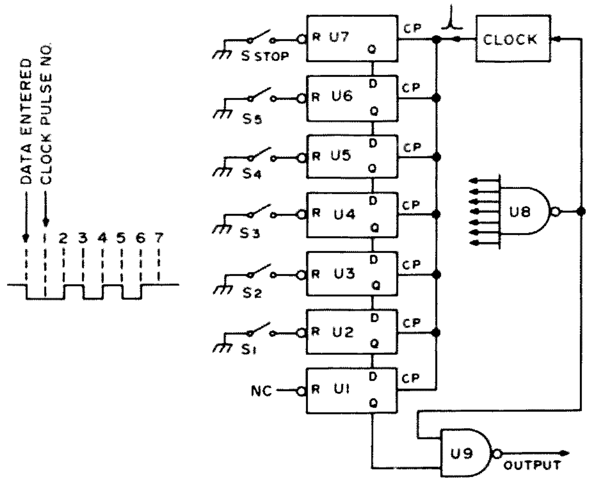
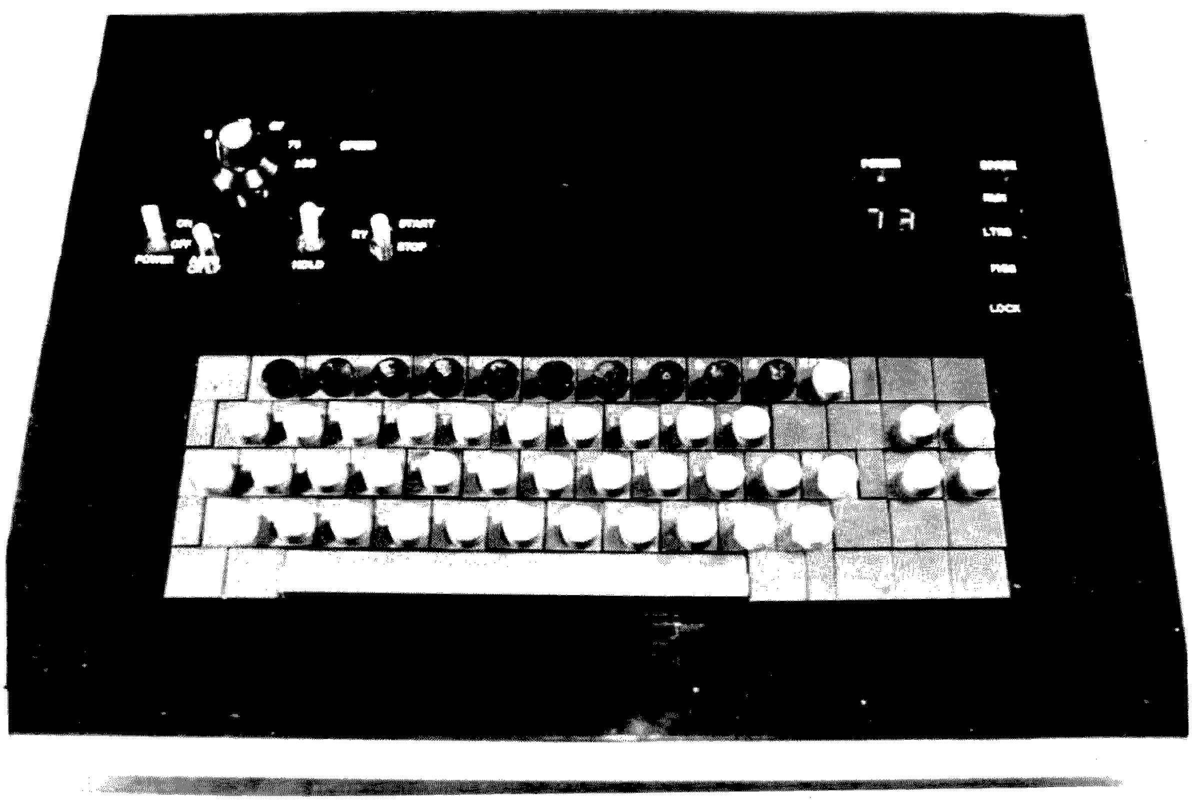
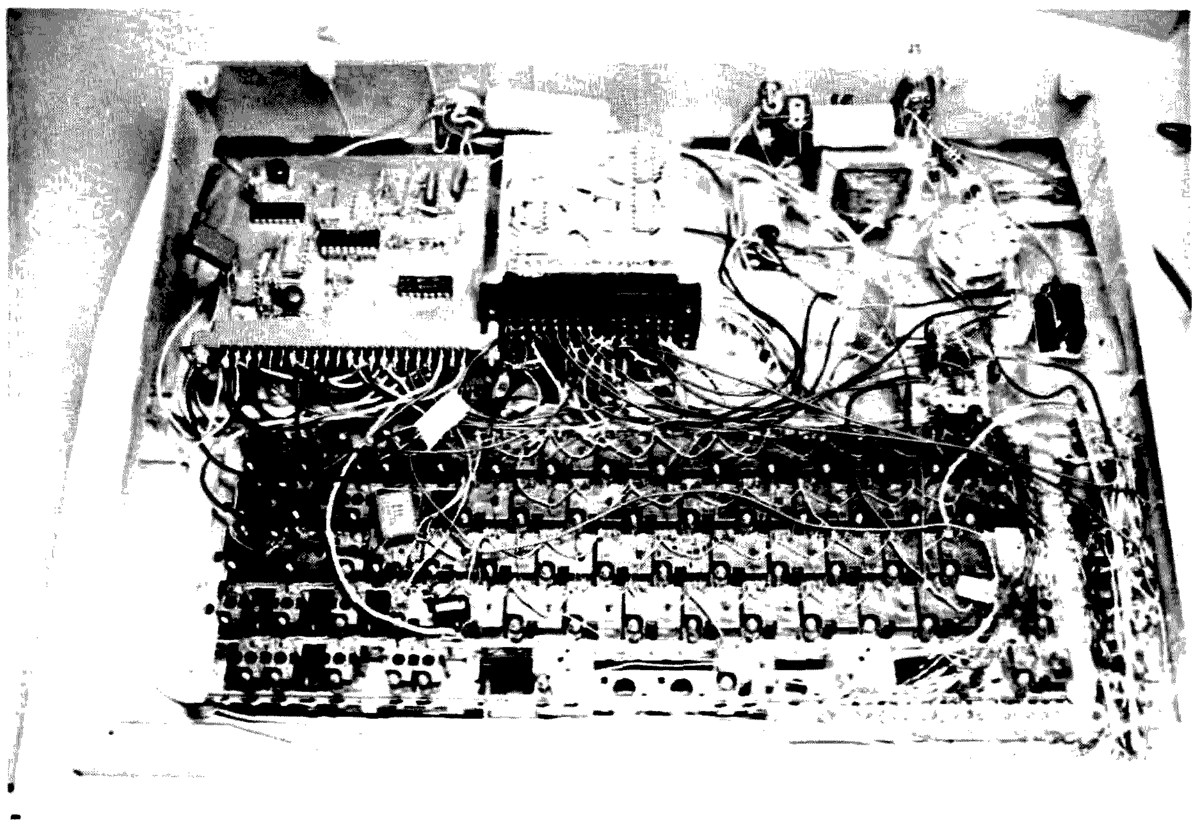


Fig. 2. Shift register and output for "R."

U8 goes low, shutting off the clock and clamping the output of U9 high. At this point the circuit is ready to begin another cycle. The circuit is relatively simple and has the added advantage of being self-clearing since any Q low state in the register is automatically shifted out. The only problem



Top view of keyboard. Note character counter display. Column of lettering on right is associated with line of function lights. From top to bottom: Space (neon bulb across loop jack), Run, Ltrs, Figs, Lock. Top of keyboard is smoked plexiglass which needs refinishing. Also note number keys along top, and period and question mark keys. These are auto shift keys, i.e., Figs is sent automatically before the character. Actually the same thing (auto shift) happens when a letter key is pressed, except Ltrs is transmitted first.



Bottom view of keyboard. Matrix on right. Middle circuit board hides 3 others below which contain keyboard logic and test generators. Circuit board on left is Auto Shift – Auto CR/LF.

now remaining is to arrange for a method to close the input switches (trained fleas?).

Encoding Matrices

Knowing the naturally uncooperative nature of fleas, an investigation was begun into electronic methods of encoding the shift register. This diligent research uncovered three types of encoding matrices.

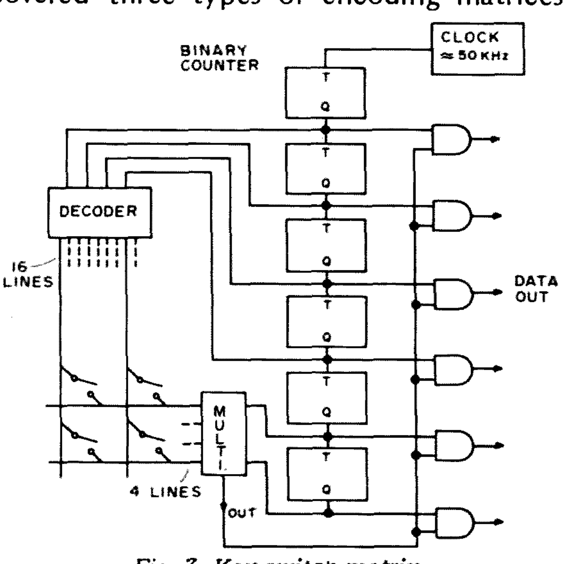


Fig. 3. Key switch matrix.

They are probably called matrices because of the rectangular form of the encoding device interconnection. Anyway, these methods are the key switch matrix, the diode matrix, and the magnetically coupled (toroid) matrix. A brief description of each will be given in case the builder would like to try a method different from the one the author used.

Of the three matrix methods mentioned above, the key switch matrix is conceptually the most complex but because of integrated circuit logic probably the simplest to construct. As shown in Fig. 3 the system consists of a six stage binary counter, a 1 of 16 decoder, a 4 to 1 multiplexer, a high frequency clock, and several gates. While only five code bits are necessary for TTY (Baudot) encoding, this encoder (and the others) includes an extra bit for Figures/Letters information used to drive auto-shift circuitry. In this particular encoder, the clock continuously drives the counter through all possible code combinations but without a key closure there is no output. With a key closure, there will appear a pulse

at the output of the multiplexer that is coincident with a counter state that corresponds to the coding of the desired character. (Did you get that?) Thus the output gates are enabled only when the counter is at the proper state. This system should work well and is used quite often commercially but was not used in this project since some of the necessary ICs were unavailable.

The second system, the diode matrix, is fairly self-explanatory. A key switch is connected to each appropriate register stage through isolating diodes. Disadvantages of this system are the large quantity of diodes required and the space required for those diodes.

The last system, the magnetically coupled matrix (Fig. 4) is actually much simpler than the name indicates. So from here on it will be known as the toroid matrix even though that isn't an exact description. This system uses a small toroid transformer for each bit output. The secondary of each transformer is connected to a transistor which acts like a normally off switch. The primary consists of a series of wires passed through the toroids from a charged capacitor on one end to a key switch on the other. There is one primary wire per key switch and since only one switch is closed at a time there is excellent isolation between the primaries. When a switch is closed, a pulse of current flows through the wire, inducing a voltage on the secondary of each transformer the primary wire passes through. These pulses turn on the associated switching transistors which in turn deliver reset pulses to the appropriate shift register stages. This system rates first in compactness and economy and

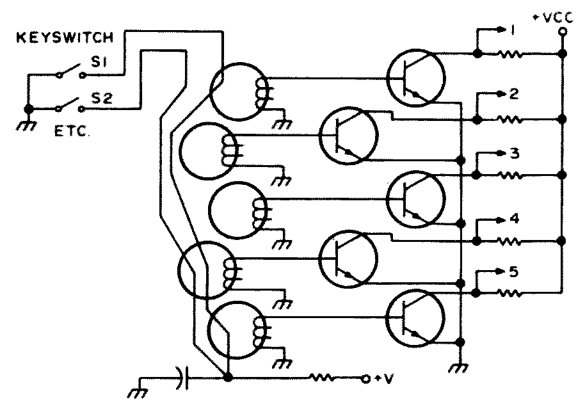


Fig. 4. Magnetically coupled (toroid) matrix. Closing S_1 generates a pulse at outputs 1, 4 and 5. Closing S_2 generates a pulse at output 4.

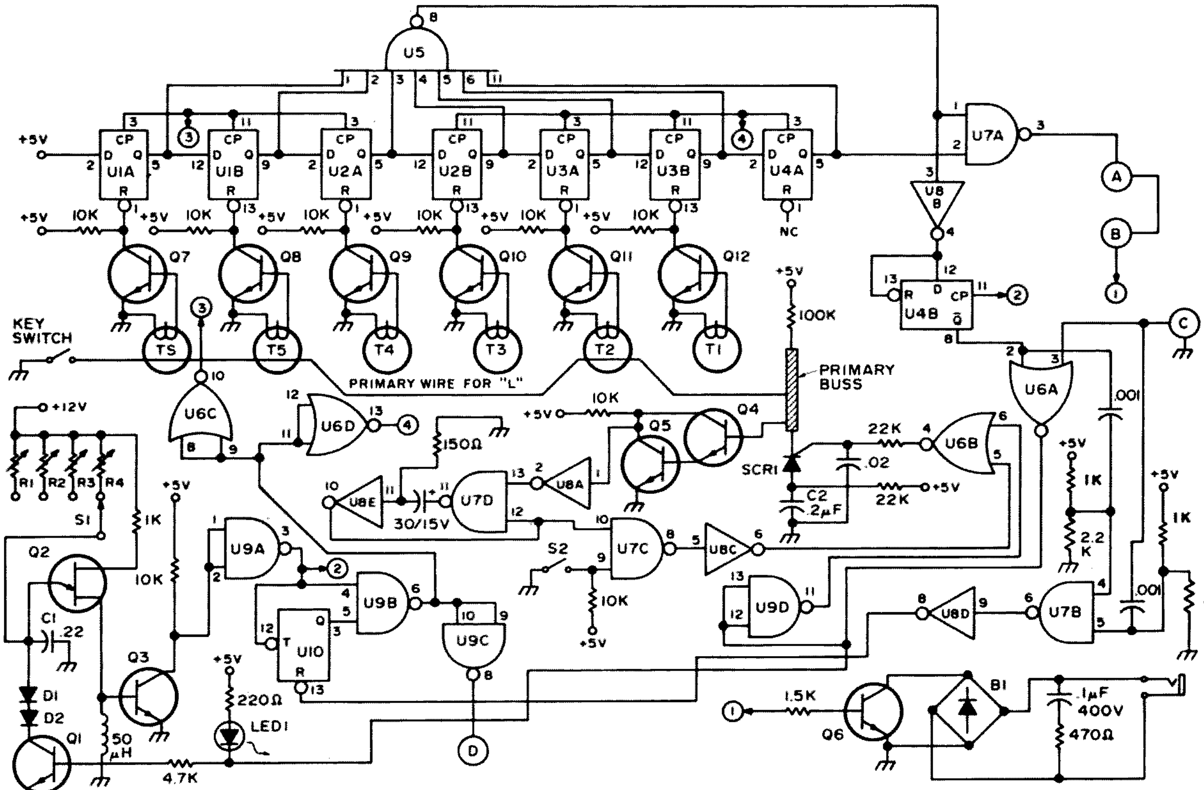


Fig. 5. Basic keyboard schematic — all ICs. Vcc connects to pin 14, ground to pin 7. Lettered terminals connect to auto function generator.

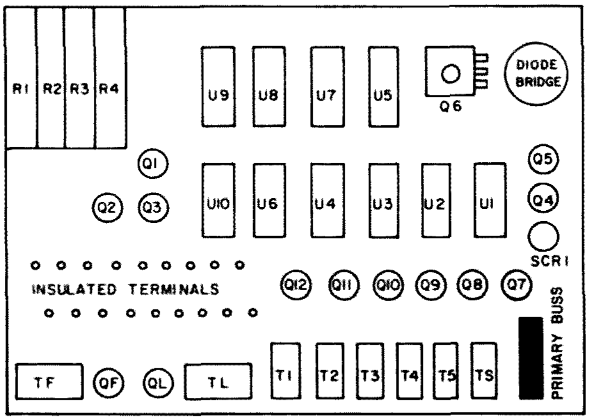


Fig. 6. Possible component layout.

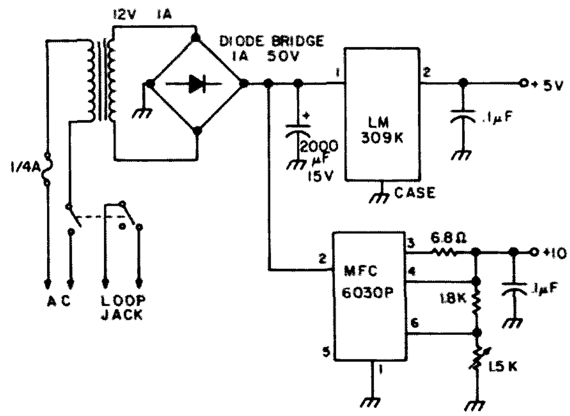


Fig. 7. Keyboard power supply.

for those reasons was included in the TTY generator.

Putting it Together: The Basic Keyboard

Now that both major sections of the TTY generator have been described, all that remains is to interface the two to each other and to the outside world (a 60 mA or whatever loop). None of the extra features are included since none are needed for generating a TTY signal. Any or all special features can be added later at the builder's option.

Because of its wide availability and low cost, 7400 series SSI is used for most of the circuitry of this project. No doubt, the circuit could be re-designed using MSI TTL or CMOS for lower package count or lower power consumption but that's for the next model. Referring to Fig. 5, the circuit consists of ten ICs, six matrix toroids, and several switching transistors. The keyboard will generate all TTY codes, including Blank, at switch selected speeds of 60, 67, 75 and 100 wpm. The stop pulse is 1.5 units long, which compares closely with the "standard" of 1.4 units.

Operation

For purposes of explanation, the circuit is assumed to be in the standby state: The Qs of all stages of the shift register are high, no key switches are pressed, and the clock is off. Since the Qs of all shift register stages are high, the output of U5 is low forcing the output of U7A high. This drives Q6 into saturation keeping the loop closed through the diode bridge. The bridge, by the way, permits the keyboard to interface with the loop without regard to polarity. The low signal from U5 is also inverted and applied to the Reset and D inputs of U4B. The $\bar{Q}$ output of U4B is therefore low, having been previously toggled by the last clock pulse of the last operation cycle. This low is inverted by U6A and applied to Q_1 which saturates and clamps the clock off. The output of U6A is also inverted by U9D (the signal is now low, in case you lost track) and applied to one input of U6B. The other input is high at this time so the output to U6B is low. The run indicator, LED_1, is off at this time.

Now we make something happen. A key switch is depressed and held. Any key would do, but for this example we'll press "L." The primary wire passing through T_s, T_5, and T_2 is grounded bringing the primary buss to ground. There is no output from the matrix at this time since the 100k biasing resistor provides insufficient current and the gate of SCR_1 is held low by the output of U6B. What does happen is that the darlington pair (Q_4,Q_5) stops conducting and its output goes high causing the output of U8A to go low. This triggers the single character one-shot (U7D and U8E) whose output goes low for approximately 1 ms. The low at the input of U7C gives a low at the output of U8C. This results in low signals at both inputs to U6B causing its output to go high, triggering the SCR. This discharges the .2 uF capacitor through the primary wire. Finally, coding pulses are generated from matrix toroids T_s, T_5, and T_2. These set the Q outputs of U1A, U1B, and U3A low. Since any low input to a NAND gate results in a high output, the output of U5 goes high. U7A is now permitted to invert the output of the shift register (which is now high) and

initiate the start pulse (the output switch, Q_6, opens). The high from U5 is also inverted and applied to the Reset of U4B. $\overline{Q}$ goes high, the output of U6A goes low, and Q_1 stops conducting permitting the clock to start. At the same time the output of U6B goes low, dropping the gate voltage of the SCR to below firing level. The SCR stops conducting when the .2 uF capacitor discharges since the 22k charging resistor supplies a current below the holding level of the SCR. The .2 uF capacitor now begins to charge. The busy indicator, LED_1, is now on.

The clock, which was started in the previous paragraph, includes Q_2, a UJT relaxation pulse generator, Q_3 and U9A (2 F buffer), U10 and U9B (1 F generator), and U6C, U6D, and U9C (1 F buffers). The pulse generator operates at twice the register shift frequency; at 60 wpm the clock produces a pulse every 11 ms. Positive going pulses at the double frequency are available from the output of U9A (2 F) and positive going pulses at the shift frequency (1 F) are present at the outputs of U6C, U6D and U9C. The outputs of U6C&D drive the shift register while U9C drives external circuitry.

Assuming we are generating a character at 60 wpm, the first shift register clocking pulse occurs 22 ms after the clock is turned on. Data in the shift register is shifted toward the output gate as has been previously described. After the seventh clock pulse, the register is cleared of all Q low data and the output of U5 goes low. This once again clamps the output of the output gate in the high (Mark) condition. The inverted output of U5 (high) is applied to the D input of U4B. Eleven ms later, the next 2 F clock pulse causes $\overline{Q}$ of U4B to go low, stopping the clock and returning the keyboard to the standby mode. The action of U4B therefore extends the seventh or stop pulse 50% longer than the other pulses in the character. The stop pulse can, of course, be longer (it depends on how fast you type) but this limits the minimum length and guarantees a 7.5 unit code.

During the time the clock is running (the run indicator is on) and a TTY character is being generated, no additional data can be

A view of the toroid matrix. All those wires running through it give the appearance of a mess, but it works. The primary buss, SCR, and C2 are located on the left side.

entered into the register because of the low signal at the gate of the SCR. To send another character, the original key must be released and then another (or the same) pressed. This will fire the U7D-U8E one-shot and permit the generation of another character. Thus only one character is generated for each key closure. If the repeat key (S_2) is closed along with a character key, the keyboard will continually reprogram and transmit that character. Note that all the repeat key does is defeat the single character one-shot.

CORE

KEY	LTRS	FIGS	STOP	1	2	3	4	5
A	•		•	•	•			
–		•						
B	•		•	•			•	•
?		•						
C	•		•		•	•	•	
:		•						
D	•		•	•			•	
$		•						
E	•		•	•				
3		•						
F	•		•	•		•	•	
!		•						
G	•		•		•		•	•
&		•						
H	•		•			•		•
#		•						
I	•		•		•	•		
8		•						
J	•		•	•	•		•	
'		•						
K	•		•	•	•	•	•	
(		•						
L	•		•		•			•
)		•						
M	•		•			•	•	•
.		•						
N	•		•			•	•	
,		•						
O	•		•				•	•
9		•						
P	•		•		•	•		•
Ø		•						
Q	•		•	•	•	•		•
1		•						
R	•		•		•		•	
4		•						
S	•		•	•		•		
BELL		•						
T	•		•					•
5		•						
U	•		•	•	•	•		
7		•						
V	•		•		•	•	•	•
;		•						
W	•		•	•	•			•
2		•						
X	•		•	•		•	•	•
/		•						
Y	•		•	•		•		•
6		•						
Z	•		•	•				•
"		•						
BLANK			•					
SPACE			•			•		
C.R.			•				•	
L.F.			•		•			
FIGS			•	•	•		•	•
LTRS			•	•	•	•	•	•

Fig. 8. Toroid matrix wiring. Where a dot appears, the primary wire passes through that core.

You may notice that there are a few extra components that seem to perform no function, such as U6A, U7B, U8D and U9C. These components are used to interface with the auto function generator to be described later. With a little re-design, those gates could be eliminated if you have no desire to include the automatic functions. That redesign would save one IC package.

Power Supply

Two supply voltages are required for the TTY keyboard: +5 V and +10 V. Both sources must be regulated for good frequency stability and proper operation of the logic. The easiest (and one of the best) way to do this is to use IC regulators. One power supply that works is shown in Fig. 7. About .5 A at 5 V and 25 mA at 10 V will supply the fully optioned keyboard. The second section of the line power switch is used to short the loop jack when the keyboard is turned off. Otherwise, the loop would run open when power is removed from the keyboard.

About Construction

Being a prototype, this circuit was not built using printed circuit techniques, but instead was built on a combination of breadboarding cards and perf-board. For those who would like to build this on a circuit card, a suggested layout is shown in Fig. 6. Notice that all the matrix toroids are on a common axis with the primary buss. With about 1/2" (12 mm) between toroid centers, threading of the primary wires is not too difficult and the matrix takes up little room.

Fig. 8 is the wiring chart for the matrix primaries. Where a dot appears on the chart, the wire passes through that particular toroid. The two extra cores listed on the chart are used to drive the auto Figs/Ltrs circuitry and can be excluded. In order not to duplicate wiring in the matrix if it is planned to include auto Figs/Ltrs (auto shift), all primaries that will involve an upper case key are connected to a separate terminal after passing through the shift register toroids (T_S&T_1–T_5). From there, one wire will pass through the Ltrs core and

to the designated lower case key switch. Another wire will connect to the terminal and pass through the Figs core and to the designated upper case key switch. For example: Both "U" and "7" have the same coding. A primary wire is connected to the primary buss and passed through T_1, T_2, T_3, and T_S. The primary wire is there attached to a terminal. One wire from the terminal passes through the Ltrs core to the "U" key switch and another wire (from the same terminal) passes through the Figs core to the "7" key switch. Only about fifteen primary wires need be treated this way: ten numerals and commonly used punctuation.

One additional thing about the toroid matrix: The polarity of the output pulse of the transformers is dependent on winding direction. Therefore all transformers must be wound as shown in Fig. 9.

The Great Keyboard Controversy

The major factor preventing the construction of any type of electronic keyboard has usually been the unavailability of an acceptable key switch assembly. To get around the problem, several previous keyboard articles have described home made switch assemblies. Well, as far as the author is concerned, home made keyboards don't work well. The problems of pretravel, post travel, and actuating pressure are often more than the home constructor can cope with. Fortunately, the price of commercial keyboards has fallen to a fairly low level on the surplus market. The keyboard used for the prototype has been available without a case from Tri-Tek for $11.50. Others are available from Meshna and B and F Enterprises for prices up to $50. These prices are quite reasonable when you consider that enough microswitches to construct a keyboard (at least 30) would cost about $12 surplus. And then you have to build the thing!

Will It Really Work?

After you have gathered the pieces for this project, figured out where to put all of them, and wired them together (don't forget to check for errors), there comes a time when you have to turn it on. Before you do, collect a few pieces of test equipment: a counter, a Teletype machine of some sort,

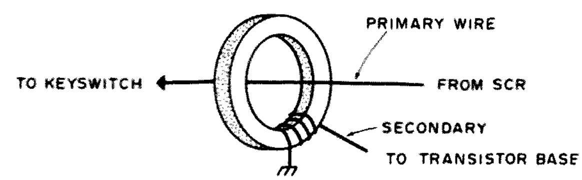


Fig. 9. Transformer winding.

and a logic probe. The counter is not essential but it makes setting of the clock a little quicker. A typing reperf would be ideal for checking the output, but a page printer will do. And if you don't have, can't find, or won't build a logic probe, a dc 'scope or a VOM will do pretty much the same job of tracing down bugs in the logic (but not as handily).

Now you can turn it on. Check for proper supply voltages and smoke. If everything appears OK and you have a counter, the clock rates can be set. Connect the counter to theoutput of U9A and ground the base of Q_1. Adjust R_1 for 91 Hz, R_2 for 100 Hz, R_3 for 113 Hz, and R_4 for 148 Hz. Remove the jumper at Q_1 and the clock should stop. Press a character key and the clock should run momentarily (the run light will blink). Press a character key and the repeat key, and the clock should run continuously. If these things do not happen, get out your logic probe and find out why before continuing. (If you have no counter, do everything in this paragraph except adjust the clock – you get to do that later.)

Now the keyboard can be connected to the typing reperf through a 60 mA loop or any other way you want to do it. If the clock was not previously timed, now is the time to give it a try. Turn the keyboard on with the speed selector (S_1) at the same speed as the reperf. If your reperf has four speed capability you will be able to calibrate all four speeds. If not, calibrate what you can (or want). At the moment, the loop should be closed. If not there may be a problem with the output switch. If there is no problem, press the "T" switch. The reperf should do *something*. Adjust the appropriate speed adjust pot and again press the "T" switch. Continue this process until the reperf prints "T." You will find that the machine prints correctly over a small range of speed adjustment. Set the speed pot in the middle of this range. If there is difficulty

in getting the machine to print "T" there may be a problem with the shift register or the encoding matrix. This is the difficulty of adjusting the clock without the aid of a counter. The technique requires that the rest of the keyboard operate properly.

If you have managed to calibrate the speeds properly all that remains is to check the coding of the rest of the characters on the keyboard. Any errors in coding will probably show up as consistently superfluous or missing pulses. These can be traced to a malfunctioning shift register stage or a particular matrix toroid. While there are undoubtedly other places in the keyboard where problems can arise, it should be fairly easy to trace them down by following the circuit description.

Next Time

The circuit described above is a simple, reliable, and not too expensive substitute for the mechanical TTY keyboard. Its ability to generate near perfect coding at any speed makes the electronic keyboard a valuable addition even if you already have a complete TTY setup. While the keyboard can be used as is, the inclusion of the automatic features makes its operation even more enjoyable. The concluding part of this article will describe those features and their operation.

Parts List

R1 – 60 wpm –20k var. + 47k
R2 – 67 wpm –20k var. + 33k
R3 – 75 wpm –20k var. + 33k
R4 – 100 wpm –20k var. + 22k
S2 – Closed for Repeat
T1 – Ts – Toroid Core – 1/4" I.D.
SEC – 10 turn No. 28 Enam., PRI – No. 28 Enam. (see text)
Q1, Q3 – Q5, Q7 – Q12 – NPN Switching Transistor 2N2222 or = (HEP-55)
U1 – U4 – 7474
U5 – 7430
U6 – 7402
U7, U9 – 7400
U8 – 7404
U10 – 74107 (or 7473 or 7472 with different pinout)
C1 – .22 uF, 50 V mylar
D1 – D2 – Silicon diode 1N914 or =
B1 – Silicon Bridge Rectifier – 400 piv – 100 mA
Q6 – MJE-340 (HEP-244)
SCR1 – 2N889 (HEP–R1001)
Q2 – 2N493 (HEP-310)

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Op Amps: Basic Primer

Operational amplifiers, or op amps, are high gain dc amplifiers. And I do mean high gain! Amplifications are on the order of 30,000 to 1,000,000, depending upon internal design and circuitry.

Op amps have two great advantages over discrete components. Economically, they represent about 1/4 to 1/2 the cost of individual components needed for a similar circuit. Secondly, they are physically more convenient for amplification of small inputs.

Within the two major tribes of IC products, op amps are linear. This means that the output is directly and proportionately related to the input. This is in contrast to digital devices which do not always obey this rule. There are, however, some applications in which we want them to operate non-linearly, such as flip flops and comparators. We can make any op amp act non-linear by exceeding its rated values.

The Innards

Op amps are usually monolithic. That is, they are made on only one piece (or chip) of silicon. By imbedding metal oxides on this silicon base we can make transistors, resistors and capacitors without the wasted space of cases and coverings. Thus, we can have many transistor amplifiers added together yielding tremendous gains. One op amp may be the equivalent of four or more amplifier circuits.

Sometimes, field effect transistors (FET) and junction field effect transistors (JFET) are made. So, if you never knew what MOSFET was, now you know. It stands for Metal-Oxide-Silicon Field Effect Transistor.

A Differential Amplifier

The symbol for the op amp is shown in Fig. 1.

The op amp is a "differential amplifier". It acts by amplifying the *difference* of the inputs only. If we impressed the same signal on each input at the same time, the two amplified output signals would be 180° out of phase and cancel.

If we feed a signal at the Non-Invert input (+) and ground the Invert input (–), our output will be in phase with the input. A signal impressed on the Invert input while the Non-Invert is grounded will be out of

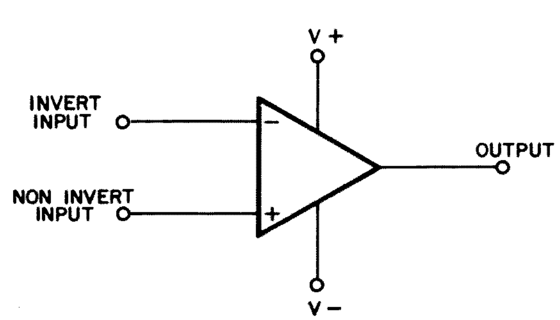

Fig. 1. Operational amplifier.

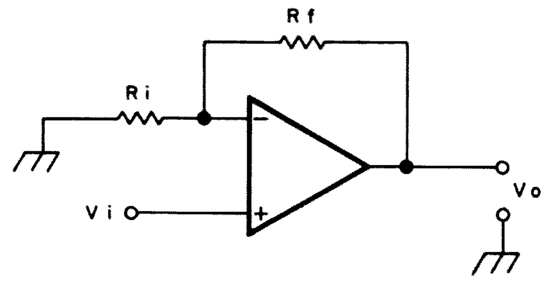

Fig. 2. Non-inverting amplifier.

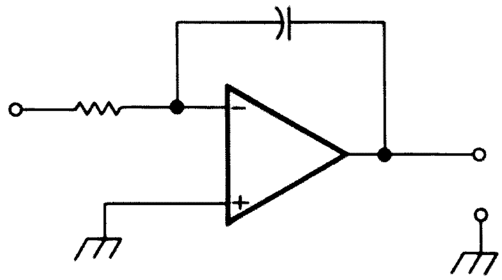

Fig. 3. Integrator.

phase when it is amplified.

The power supplies, V+ and V−, are separate entities. We need a + supply and a − supply, usually 15 volts or less. To only supply + 15 and then ground the negative will not give the proper potential. Batteries are often used.

A Few Basic Circuits

The most important and most used application of op amps is of course as amplifiers. Fig. 2 shows a typical amplifier.

It is called a *non-inverting amplifier* because the output is in phase with the input. Employing negative feedback (the feedback circuitry goes to the − input), it is the backbone of more complex amplifiers.

As with any amplifier, we have gain. The choice of input and output resistors (Ri and Rf) determines our gain. We try to come as close to our ideal gain while keeping other needs and special criteria in mind. This is similar to a tube situation where we try to come as near as we can to mu.

The next two circuits are opposite in purpose and design. They are the *integrator* and the *differentiator*. The *integrator* shown in Fig. 3 has a capacitor in the feedback circuit and a resistor in the input. It takes the sum total of the input signal over a specified time.

If we had a weird input as in Fig. 4 and we wanted to know the total voltage from time a to b, the integrator could do this for us. Mathematicians call this integration and use the symbol $\int$ to show it. In geometry we find the area under the curve by doing the integration of the equation of that waveform. It can be thought of as adding together a great number of individual shapes so thin and close together that they approximate rectangles. And we know how to find the area of rectangles quite easily.

The integrator does this adding technique for voltages, and is the basis of the analog computer.

The *differentiator* shown in Fig. 5 is just the opposite. It has a capacitor in the input and a resistor as its feedback component. Instead of adding the input signal it will respond to each and every change of the input. Since the capacitor will not pass dc, only discrete changes (ac) will be seen at the output. It is useful in instruments for obtaining the rate of change of voltages.

Remember the cathode follower from your license exam? In the IC world we have the *unity gain buffer*, also known as the

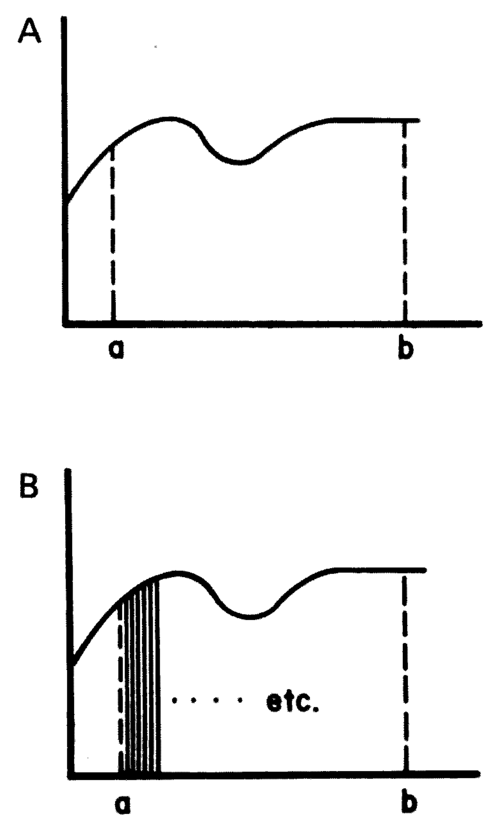

Fig. 4. (a) Weird waveform. (b) Weird waveform with rectangles.

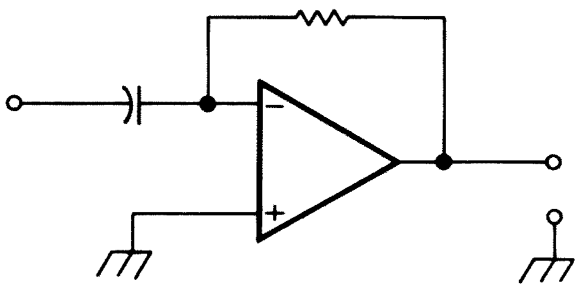

Fig. 5. Differentiator.

voltage follower. It has a gain of 1 and is used as an impedance matcher. High input impedance and low output impedance make it an excellent buffer between stages.

Compensations

As in other very precise and sophisticated devices, op amps must be compensated for many variables, external and internal.

Frequency Compensation

Op amps have difficulties at high frequencies. At these frequencies they do not amplify all inputs equally and thus there is a decrease in gain. This decrease can cause phase shifts due to time delays. The answer is to use a large capacitor in the circuit. Many op amps are internally compensated for this high frequency loss. They already have a capacitor within the chip. Some have provisions for external compensation. This information is in the specs.

Output Offset Voltage Compensation

In an ideal negative feedback circuit, the output is zero when our input is zero. But nothing is ideal. Very often there is a large (relatively speaking) dc output which can adversely affect performance. Due to slight mismatches in internal circuitry and design, we have two unwanted inputs which cause this unwanted voltage.

The first of these unwanted inputs is the Input Bias Current. As said before, op amps are a myriad of transistors. These semiconductors must be biased to conduct. No matter how well we try to match these biasing currents they will never be equal.

The difference of these currents passing through the resistors in Fig. 2 causes a voltage which will be amplified. In order to reduce this problem we add a resistor to the Non-Invert input. This new resistor reduces the input voltage because now the *difference* of the bias currents flowing in the op amp is made less than *either* of the bias currents. They have become negligible variables. (Remember, only input *differences* are amplified.)

Our next unwanted input is due to intrinsic chip characteristics. This Input Offset Voltage is usually small enough for most applications, but if it is not, we make use of the "Offset Null" tabs of the IC. By placing an external potentiometer across these terminals we can null our voltage to exactly zero.

Other Parameters

Other variables and factors are worth mentioning. They are seen in most specs and are *not* self-explanatory.

The first is *slew rate.* This is the maximum rate of change the output can negotiate. The slew rate is *always* given in spec charts and can be used to compute switching time needed between maximum output levels of our specific circuit. It is important in switching applications where

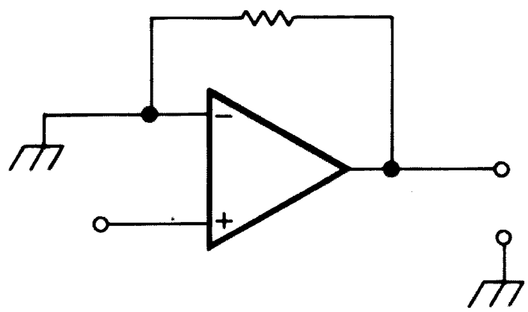

Fig. 6. Unity gain buffer or voltage follower.

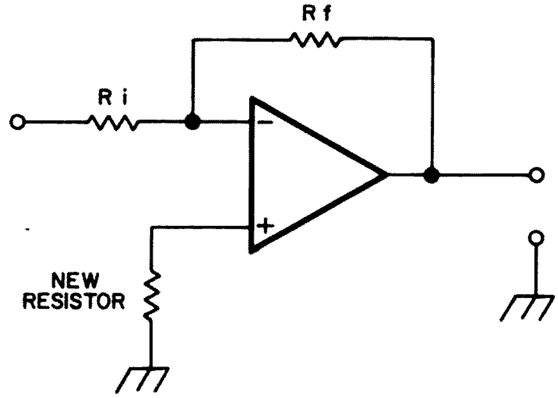

Fig. 7. Compensating resistor added.

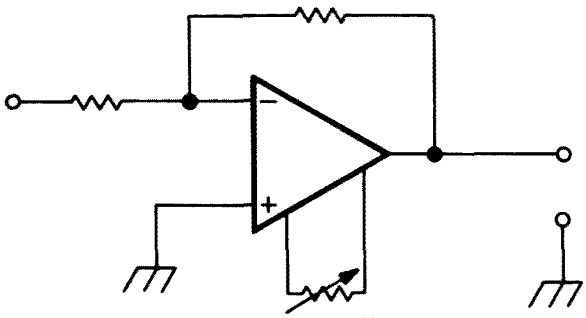

Fig. 8. Offset null potentiometer added.

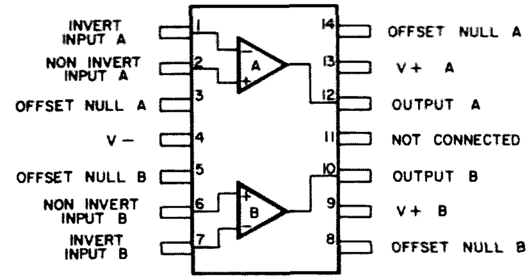

Fig. 9. 747 op amp. The 747 is internally compensated for frequency.

we must be careful not to design our output time to be faster than the op amp can handle.

The second is called the *common mode rejection ratio (CMRR).* Remember that the op amp responds only to differences of input. We would like it to reject all similarities in inputs but we settle for what we can get. This CMRR is a measure of how well the op amp rejects common inputs. Measurements are in dB, and the higher the better.

And thirdly, like all semiconductors, saturation can be a problem. *Latch up* is the aspect of op amps to stay at saturation, either + or −, after their maximum differential voltage has been reached. At this point the op amp will not behave linearly.

The 741 op amp is an example of a device which has lessened this problem by incorporating a very high input voltage rating.

What They Look Like

Op amps come in two shapes, DIP and TO. DIP means Dual-In-Line Pins and is the rectangular or square chip with parallel terminals on opposite sides.

TO stands for Transistor Outline, and is so named because it is in the shape of a transistor. You will often see a "5" after the TO. This is a unit of size and is needed for heat sink and space criteria applications. Most op amps are TO-5.

The Inside View

The top view of a 747 op amp would look like Fig. 9 if we X-rayed it. The shape is DIP.

The 747 is internally compensated for frequency.

The 748 chip is a TO-5 package and has provision for external frequency compensation (see Fig. 10).

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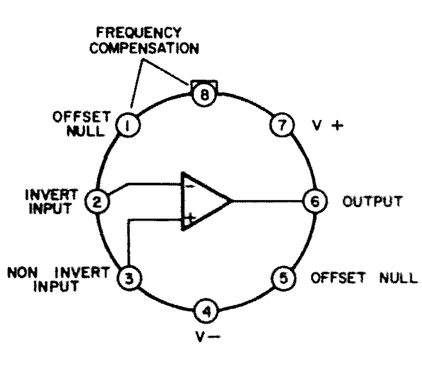

Fig. 10. 748 op amp.

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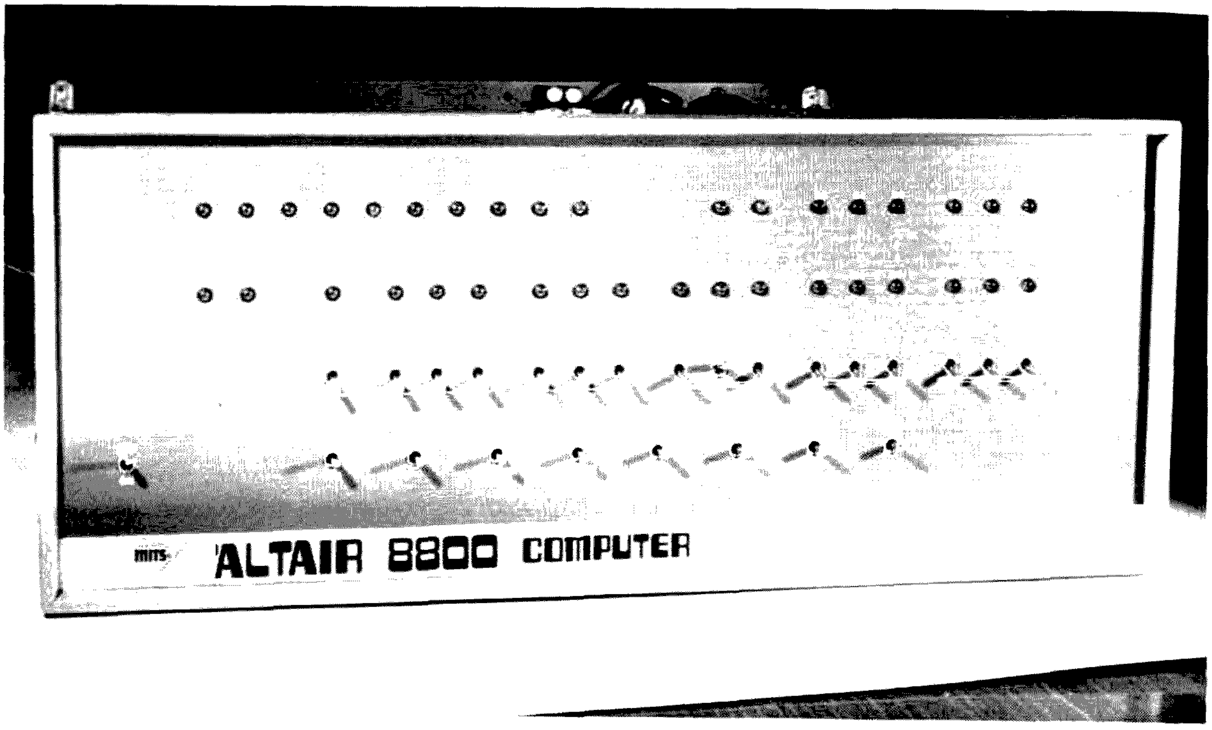
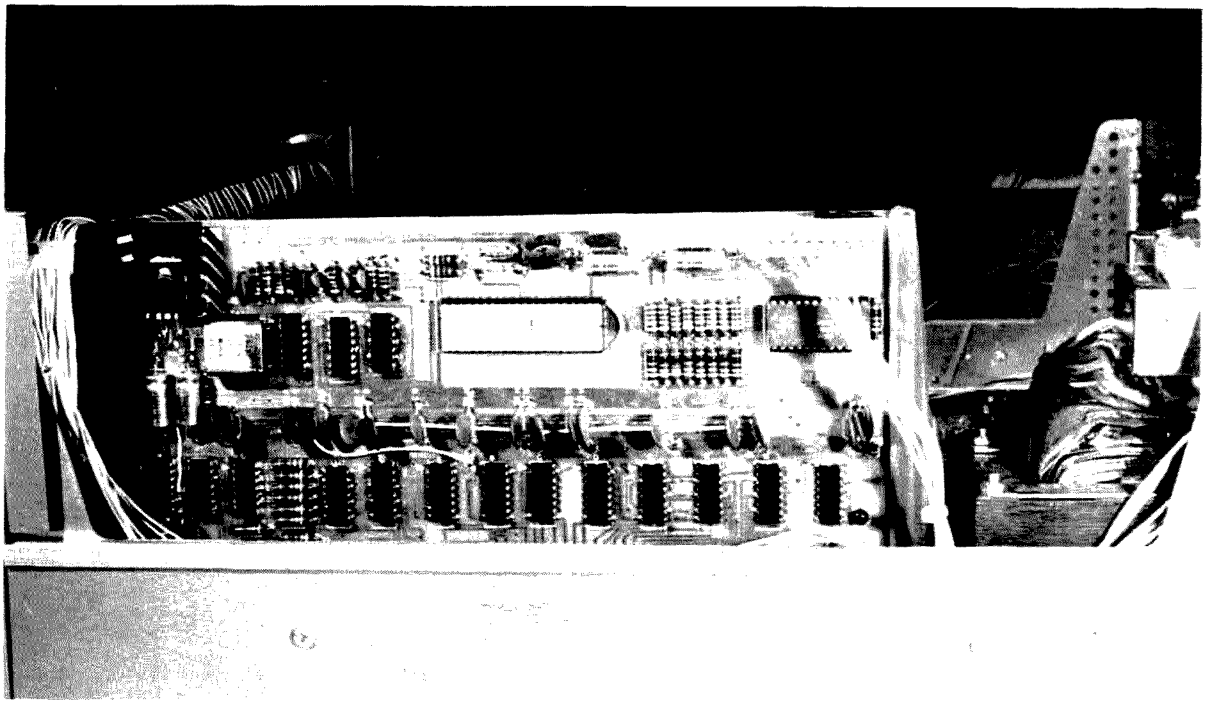
Computers Are Here - Are You Ready?

Like Duz (do they still make Duz?), computers are getting a reputation for being able to do just about everything. It is well earned, for to understand computers is to love them . . . they are being billed as the World's Greatest Toy, and this is not much an exaggeration, young long-haired blonds notwithstanding.

More and more amateurs are tackling the new inexpensive computer kits and coming up with very usable results. Some are using the units to aim their antennas for moon-



The Altair 8800 . . .



and a look inside.

bounce, some to predict or even aim antennas at Oscar, some to operate a virtually automatic RTTY station, some to run a repeater or even a system of repeaters . . . and so forth.

The Three Basics

There are three parts to a computer system ... the central processing unit, cleverly called a CPU, the gadget which costs the most money and which does most of the work ... an input/output device such as a teletype ... and some sort of memory for the CPU to keep things on file when it is not actively working with them.

IC technology has been raising havoc with CPU prices, dropping them in large increments every few months. The latest chips such as the Intel 8008, 8080, National PACE, IMP-16, and Motorola M6800 have spawned a breed of miniature CPU which is so low in cost that it has made the hobby computer a practicality. The first large quantity production of CPUs using the new series of microprocessor chips was put out by MITS in January ... their Altair 8800. This sold for $439 in kit form and $621 assembled and tested ... about one tenth the price of previously available minicomputer units.

RGS Electronics and Scelbi Computer Systems had been producing computer kits before this using the Intel 8008 chip, but these were not as well publicized and the 8008 chip has more limitations than the 8080, which is used in the Altair.

More and more CPU kits are becoming available ... such as the recently announced Godbout system using the National PACE chip ... this holds a lot of promise for a lot of computer at a ridiculously low price. Another new one is Sphere, available in kit or assembled form in the same basic price range of $500-$600 with enough built-in memory to do some work.

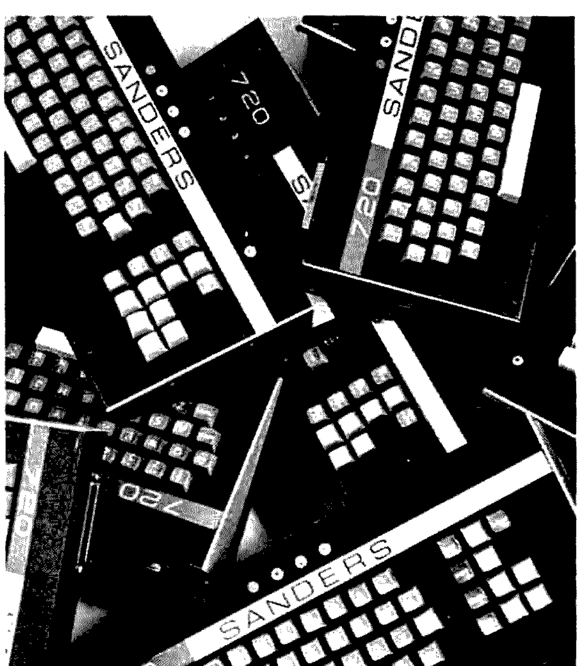
There are two basic forms of memory required ... one in the CPU to permit it to do its work ... and one outside for longer term use. The internal memory stores operating program instructions and things retrieved from the larger memory which have to be used by the CPU. Practically speaking, the larger the internal memory of the CPU, the faster your computer system can operate. For instance, if you had a record of all of the stations you've ever contacted in the main memory and you wanted to sort through for one particular call, it would be easier to find if your CPU could grab a thousand stations out at one time and check them against the call you need instead of checking maybe ten at one

time. You'd find the record you want one hundred times faster.

But, alas, memory costs money, and a happy medium has to be struck between what you want and what you can afford. You can get along with 4k of memory . . . that's actually 4096 bytes, where a byte is 8 bits of memory, the amount needed to represent a letter or number. Memory costs about 4¢ per byte today, but it will be coming down.

Long term memory units have been coming down in price too, though it is still possible to buy a brand new Ampex 40 Megabyte disk system for $24,000 if you like to pay list price and get into that sort of scene. More in the amateur end are some of the soon to be seen floppy disk systems which will be selling in the $500 range and which will provide about 250k of memory on each disk. The disks are a lot like phonograph records and can be changed quickly.

One of the simplest and least expensive memory systems involves the audio cassette recorder, and many hobbyists seem to be working in this direction. It is a little slow, but it is extremely cheap and you can have a lot of memory that way. The standard for using them is a familiar one, with the two RTTY audio frequency shift tones being used.



Keyboards from Sanders: Running rampant.

Even the input/output situation is changing rapidly. Of course you can buy an old teletype machine for $50 to $100 and it will work quite well. You might even want to go to a faster and more modern machine, if you can promote one at less than the price of a good used car. The more usual system now is to put together a video display terminal and work from that. These are available in kit form for around $150 to $250 and are a cinch to put together. The Southwest Technical video display generator costs $175 in kit form and can put together by a 12 year old. The keyboard that goes with this one runs another $40 and works like a champ. Or you may want to shop around for a surplus keyboard for the same or a slightly lower price . . . most of them have ASCII output and this is all you need to hook things together for a working system. (American Standard Code for Information Interchange = ASCII.)

Uses

Once you have your CPU, memory and I/O up and working, you then have to decide what you want to do with the system. You may want to use it to keep track of stations you've worked, with little bits of information about them for recall on the video screen (any television set will provide the video part of the terminal for you). You may want to catalog your record collection or your book library . . . or perhaps articles in the ham magazines.

If you are into RTTY you realize that your computer system is the main part of a RTTY station. You can program it to send at 60 words per minute, either from the keyboard or from any material you have in the memory . . . and receive the same way, printing it out (and memorizing the stuff, if you want) on your screen.

Perhaps you prefer CW . . . so program the computer to convert the ASCII letters into appropriate CW characters . . . select the speed you prefer . . . and type away as fast as you like for several hundred words. Your computer can also decipher incoming CW for you and print it on the screen. There probably will be a good deal of 50 wpm CW around in the future as computer-assisted ops work each other.

Your checkbook? No strain, many hobbyists are using their systems for keeping their bank accounts in order.

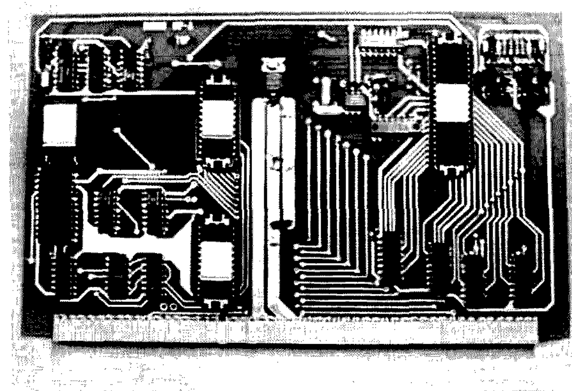
If you have a small business of your own you may want to apply some of the computer power to it . . . inventory . . . accounts receivable . . . mailing lists . . . things like that.

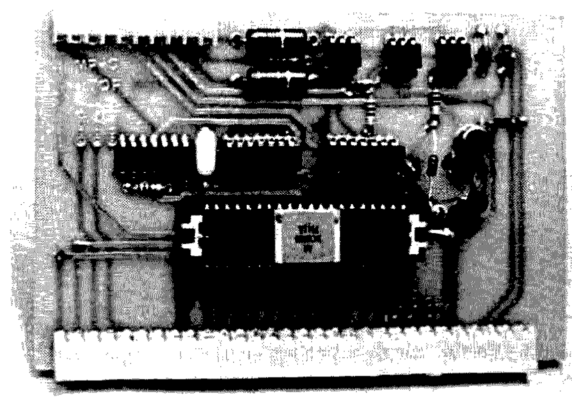
Programming

This is a bit sticky right now, but the situation is improving. One problem has been that there have been a whole lot of computers designed, but not all that many of any one model . . . so the programming work has had to be done over and over to match each new machine that has been developed. And as computers have gotten more and more complicated, programming has followed . . . usually increasing about ten times in difficulty for each increase in complexity of the CPU. Thus, while CPU costs have been dropping rapidly, programming (software) costs have been going up by like amounts. This may improve as more and more identical computers are made available . . . a benefit of mass production.

The problem with programming is that it takes forever to put in instructions when you have to do it one single step at a time. The idea is to enable the computer to translate simple words and instructions into all of the ones and zeroes which the machine requires to do its digital job. These simple yesses and nos are called machine language . . . it is the only language the CPU will understand until you "teach" it (via a program) a more complicated set of instructions, thus enabling it to translate.

The manufacturers of most computers spend a lot of time and money working out the translations (programs) and they are usually reluctant to give these away. MITS has implemented Basic and has it available for about $60 when you buy a 4k memory board. A number of small groups have formed to provide cooperative efforts on developing programming and many of the more popular computer systems have user groups who swap programs.





CPU and Serial Interface boards from Southwest Tech.

Learning About Computers

An unfortunate number of the books which have been published with the purported aim of helping you to learn about computers are just plain terrible. The fact is that the rank newcomer to computers is in for a very difficult time. The magazines (with the exception of BYTE, which sort of resulted from this situation) are written for professionals and have little of interest or value to a beginner. Little is written for the experimenter, the circuit designer, or the programmer . . . with most magazines being devoted to the business end of the computer field.

73 author Pete Stark has written an interesting introduction to computer programming which is scheduled to be reprinted by Tab Books . . . watch for an announcement of that one. The Lancaster TTL Cookbook is fine for hardware fans . . . published by Sams at $8.95.

Adding Two Plus Two

The basic CPU usually comes with a set of switches, one for each of the eight bits which make up each byte of information (each character). One set of LED lights indicates which memory location is open for use and the other set indicates what is in that memory at the time. To machine program such a CPU you flip the "examine" switch and the lights will then indicate what is in the first memory position. You set the switches according to the instructions that tell the CPU what you want it to do. Let's say you want to do something very simple at first like add two numbers. Here's how you'd go about it.

There are eight bits to be put in each memory bin. To save a lot of writing and work these are abbreviated. Written out they would look like this:

00 000 000

If you've read about binary numbers you know that 000 = 0, 001 = 1, 010 = 2, 011 = 3, 100 = 4, 101 = 5, 110 = 6, 111 = 7. Thus, using this notation, a binary number such as 01 011 111 would be written 137. Got it? That's called octal notation (base 8).

The Intel 8080 chip in the MITS Altair 8800 has a bunch of instructions built into it when you get the unit. This tells you that, if you set the first memory to 072, this will instruct the CPU to pick up whatever number you have in a specific part of the memory and put it into a small working memory unit called register A . . . this is all done inside the 8080 chip. When we push the "deposit" switch this puts the 072 into the first memory position. Next we set up the switches for 200 . . . this is the place where we will put the number we want to add. We push the "deposit next" switch and this puts the 200 into the second memory position. After consulting the instructions again we set up 107, which means move what we had in register A to register B. "Deposit next" takes care of that.

Now we pick up the second number . . . the one we want to add to the first. 072 (deposit next) says move to register A the contents of what we say next . . . 201 (deposit next). A 200 instruction tells the chip to add A to B. Then an 062 tells the

A typical test set-up – thorough – at SWT.

chip to move that sum to whatever location we say next . . . we pick 202 and deposit that information. We end the operation by telling the chip to jump back to 000 again and wait for further instructions.

All you have to do to add is put number 1 into location 200, number 2 into location 201 . . . push the "run" and then the "stop" switches and turn the switches to read out what is in memory position 202 . . . presto: the sum of the two numbers.

Perhaps you can see why machine language is a back breaker and why everyone wants to get programs which will enable them to merely type in something simple like: A = 300, B = 5.3, C = A x B, PRINT C, END, RUN. There are a great many computer languages . . . something over 700 in current use . . . but a few have come into more popular acceptance such as RPG, Cobol, Basic, Fortran, and such.

The most basic of instructions to the computer are usually put in by means of punched tape or by cassette . . . such simple programs as assemblers. This is a lot faster than sitting there flicking bat switches for each of the eight bits to load a program into a couple thousand memory positions . . . your fingers and patience would wear out. So would the switches after a while.

If you get into this field you'll find that most of the computer languages are relatively simple . . . you just have to sit down for a few days and work with them until you get the hang of the things and learn to correct your mistakes . . . and you'll make a lot of them. Programming is difficult only because it is exacting – a computer does not forgive errors, it just compounds them for you. It takes a lot of time and patience to beat new trails . . . so it is fortunate that user groups are proliferating to provide exchanges of programs . . . why keep on inventing the wheel, right?

I hope I haven't worried you about computers . . . they are not very expensive these days . . . are getting cheaper . . . and are an enormous amount of fun to play with. Get cracking . . . and as you conquer new territory, make a chart for the rest of us and send in the information to 73 and BYTE.

. . .W2NSD/1

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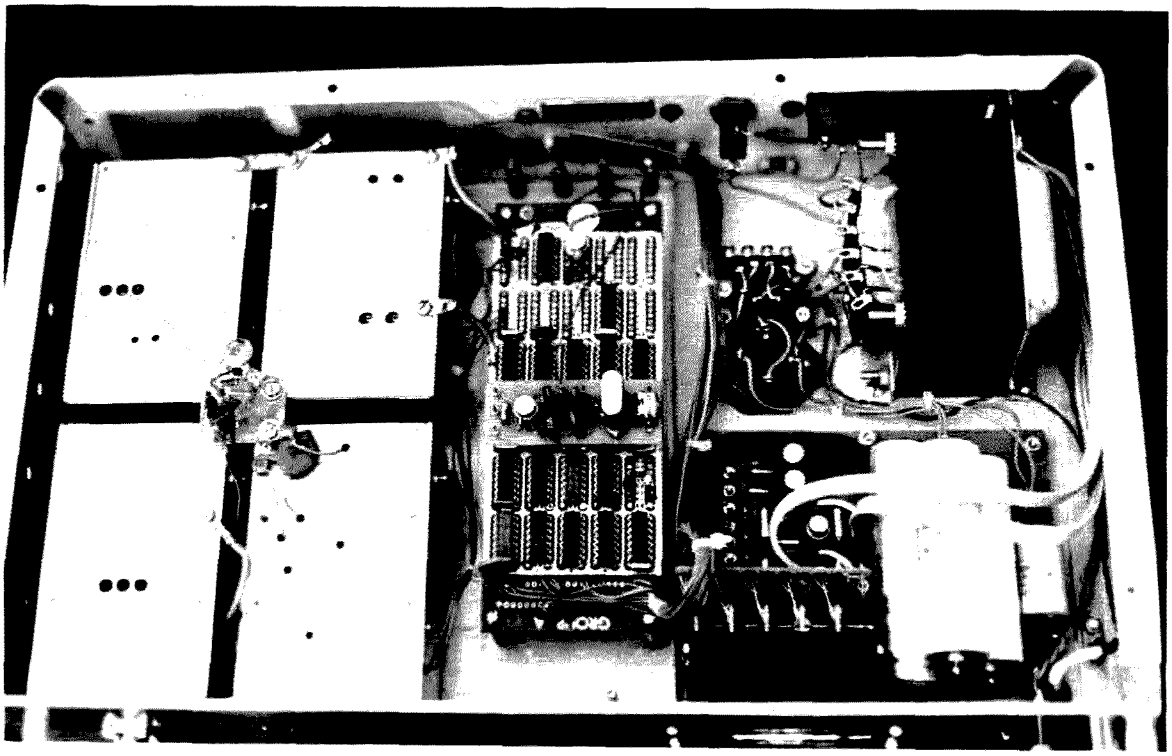
0-60 MHz Synthesizer

Conclusion

The circuitry of the synthesizer is conveniently divisible into the following groups: PLL A, PLL B, PLL C, PLL D, low frequency crystal oscillator, high frequency crystal oscillator, mixer and output amplifier, and power supply.

PLL A

The circuit of PLL A is shown in Fig. 9. FET Q1 forms a voltage controlled oscillator whose frequency is a function of the bias on hyper-abrupt tuning diodes D1 and D2. The oscillator is buffered by A1, and squared for use by ECL by A2 and A3.



Top view.

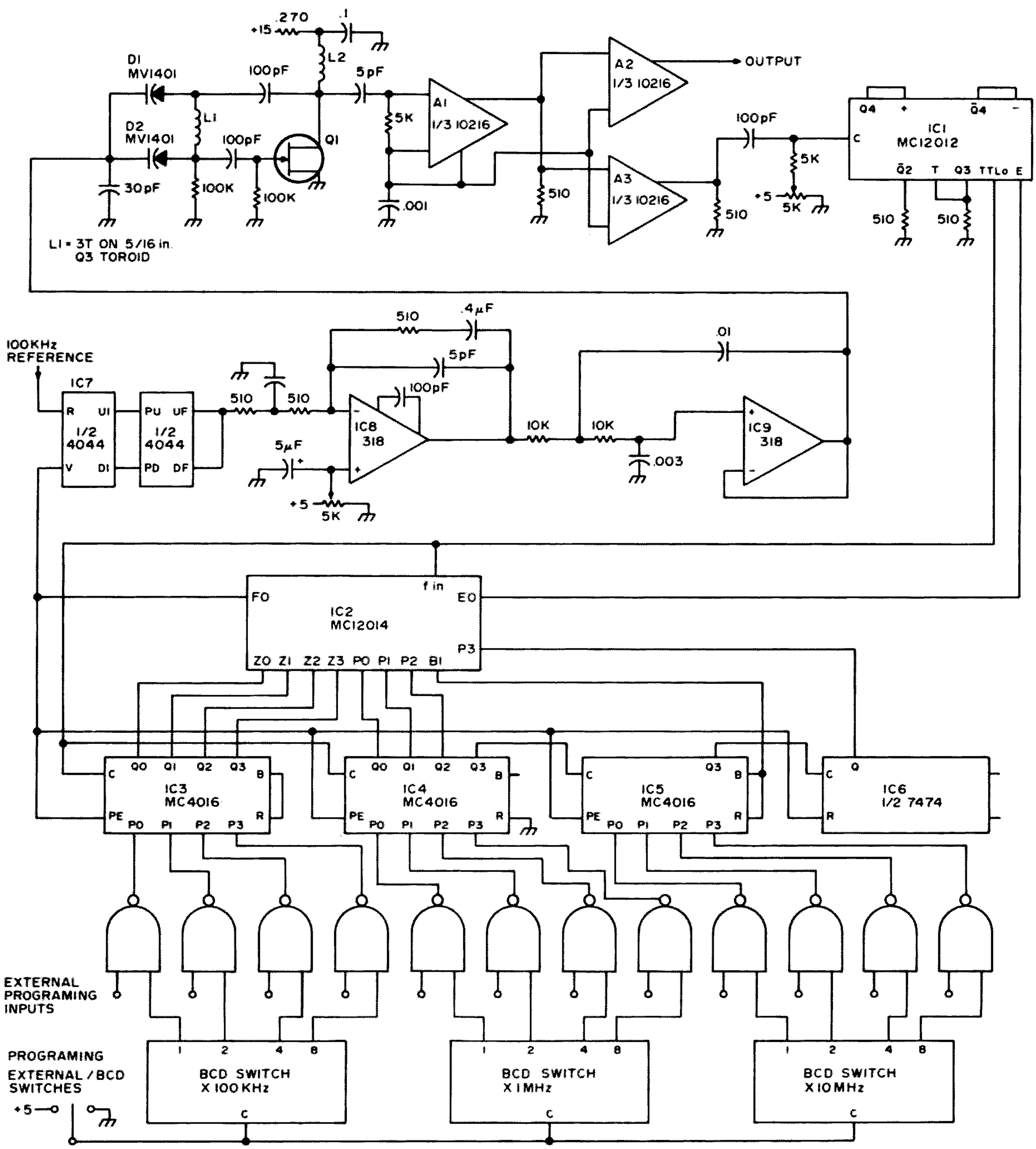


Fig. 9. PLL A.

The signal from A3 is capacitively coupled to prescaler IC1, with R1 set to the optimum bias to compensate for slight differences between prescalers. The control logic and 4016 counters form a programmable divider which can be programmed either by the front panel switches or by an external source to divide by any integer between 1000 and 1999.

The output of the programmable divider is fed along with a 100 kHz reference into phase detector IC7. The output of the charge pump is fed into integrator IC8, and then through low pass filter IC9 to reduce sidebands. The loop is closed by connecting the output of the low pass filter to the VCO.

With the component values shown the loop has a response time of about 2 ms and a maximum operating frequency of 180 MHz.

PLL B

The circuit of **PLL B** is shown in Fig. 10. IC11 is a voltage controlled oscillator with a TTL compatible output. Its frequency range is about 1-3.5 MHz over an input voltage range of 1-4.5 volts.

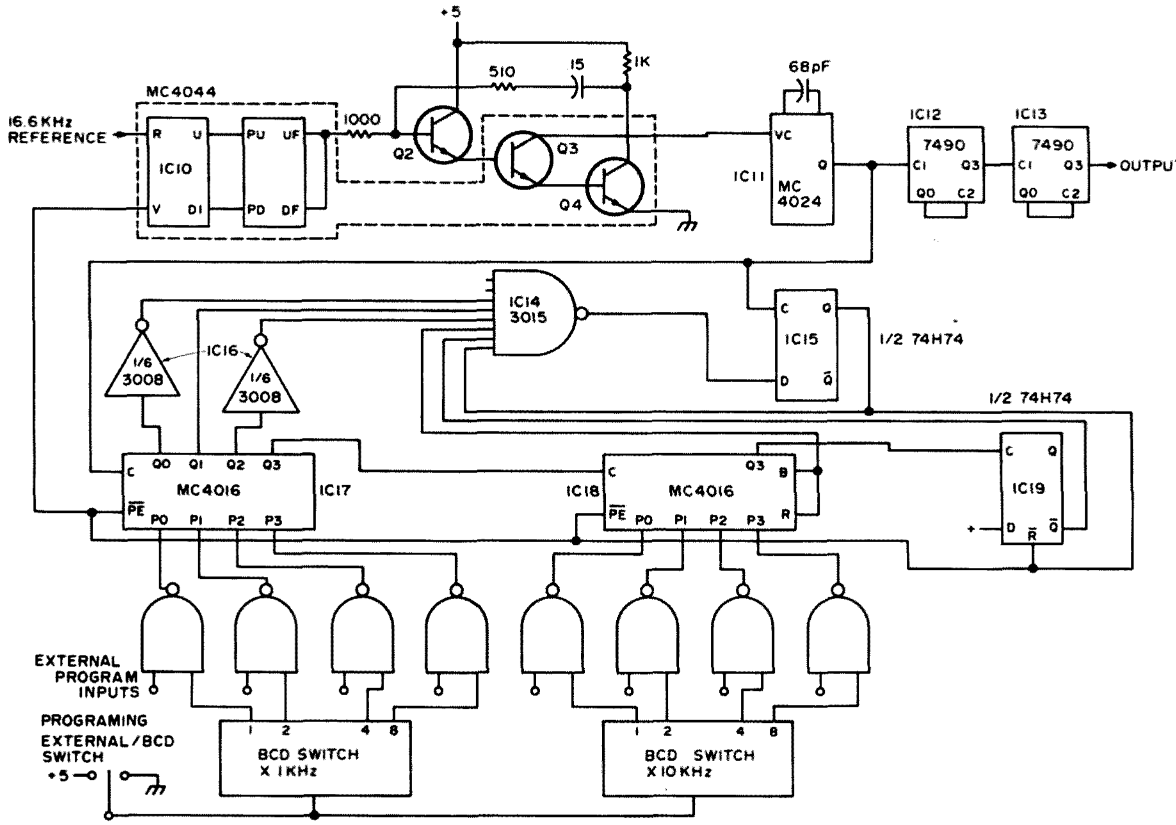


Fig. 10. PLL B.

Its output is fed directly into a programmable divider formed of ICs 17, 18 and 19. The divider is programmable by front panel switches or external inputs to divide by any integer between 100 and 199. ICs 14, 15 and 16 perform the early decode function.

The output of the divider is fed into phase detector IC10 along with a 16.666 kHz reference. The output of the charge pump is fed into an integrator formed of transistors Q2, Q3 and Q4 – Q3 and Q4 being part of IC10. The loop is completed by coupling the output of the integrator back into the VCO.

ICs 12 and 13 divide the VCO output by 100.

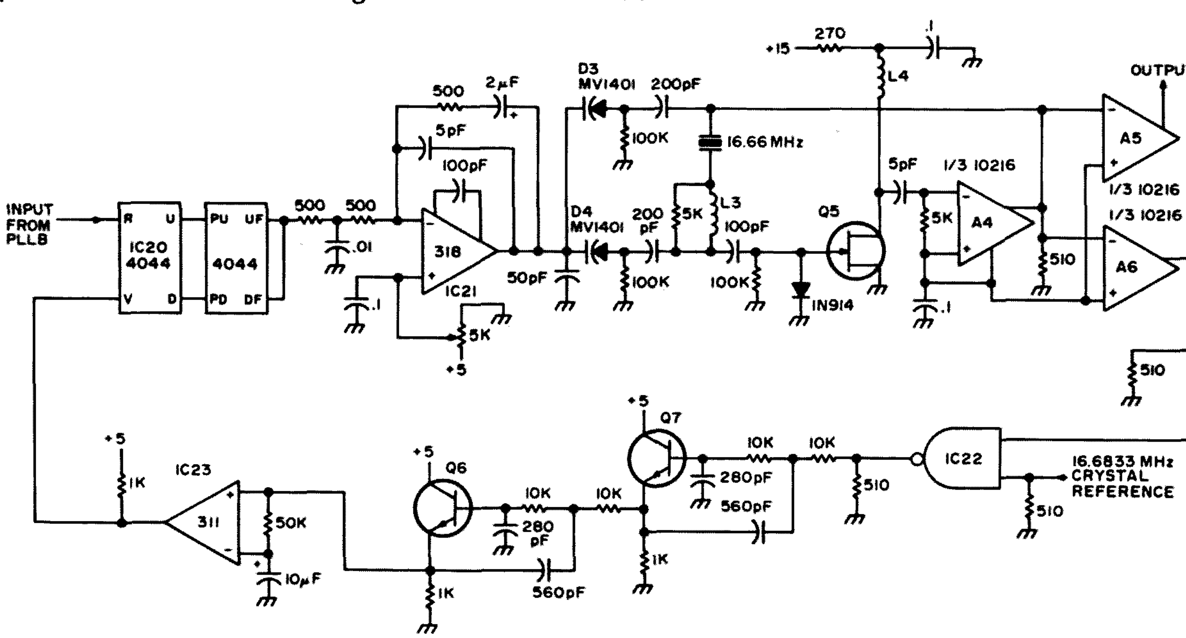


Fig. 11. PLL C.

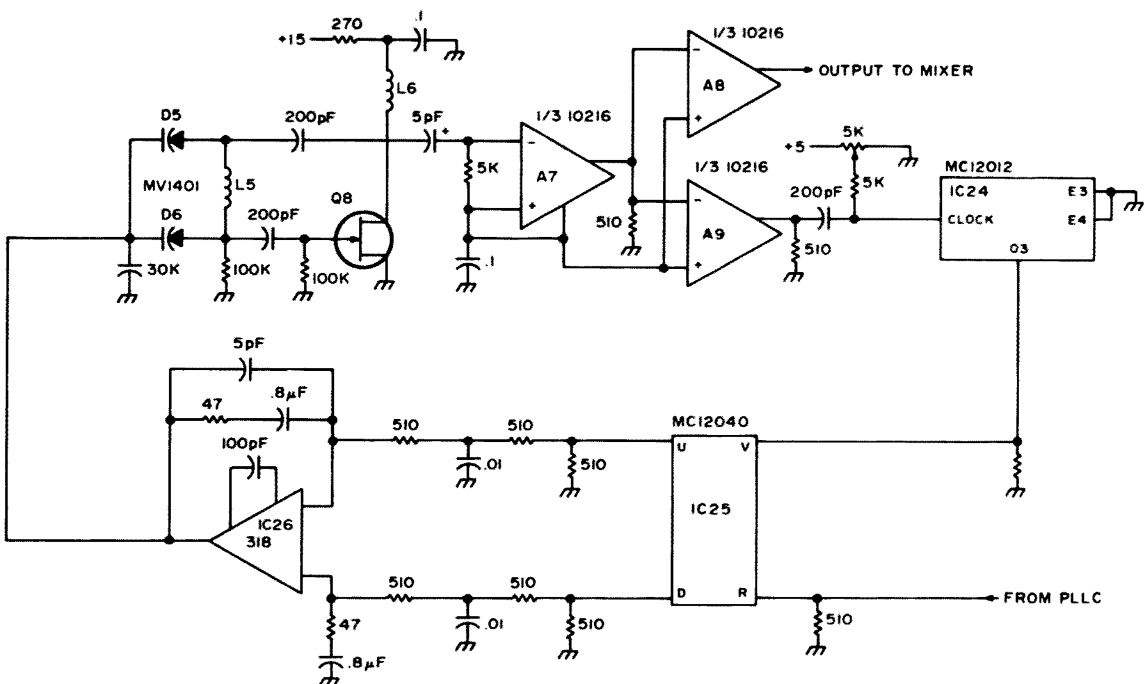


Fig. 12. PLL D.

PLL C

The circuit of PLL C is shown in Fig. 11. FET Q5 and A4 form a voltage controlled crystal oscillator capable of pulling the crystal frequency by nearly 0.3%. D3, D4 and L3 form a voltage controlled delay network which varies the point in the cycle at which drive is applied to the crystal; A4 amplifies and clips the feedback signal to maintain uniform drive and stable operation even at long phase delays. A5 and A6 are buffer amplifiers.

IC22 is an ECL NAND gate which serves as a mixer. Q6 & Q7 are connected as low pass filters to leave only the difference frequency, and comparator IC23 amplifies and squares the signal to TTL levels.

This signal, along with the output of PLL B, is fed into phase detector IC20. The output of the charge pump is fed through a low pass RC filter and then into the integrator, IC21. The loop is completed by connecting the integrator to the VCO. The use of a voltage controlled crystal oscillator has a number of advantages. First of all it has virtually no internal noise, and this keeps synthesizer output clean. Second, because of its very limited frequency range, no provision has to be made to prevent the PLL from attempting to lock to the upper beat frequency rather than the lower.

PLL D

The schematic of PLL D is shown in Fig. 12. Q8 is connected as a voltage controlled oscillator, with buffer A7 and squaring amplifiers A8 and A9.

A9 is coupled to prescaler IC24, in this case used as a fixed ÷6 prescaler. The output of the prescaler is fed along with the output of PLL C into IC25, a high frequency ECL version of the 4044 phase detector.

Because of the high frequency, a charge pump is no longer used, and the output of the phase detector is fed through low pass RC filter sections into a differential integrator.

This PLL operates as a fixed X6 frequency multiplier.

Mixer/Amplifier

The circuit of the mixer/amplifier is shown in Fig. 13. The outputs of PLL A and

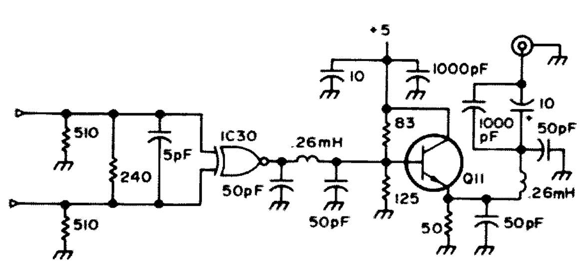
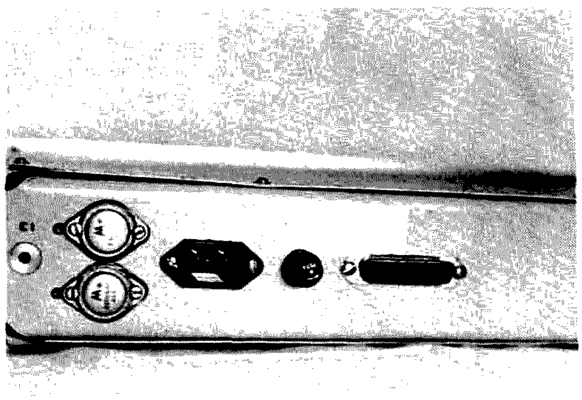


Fig. 13. Mixer/Amplifier and filters.



Rear view.

PLL D are fed into ECL exclusive *or* gate IC30. The gate multiplies the two signals, mixing them very efficiently. Because of the limited slew rate of ECL IC30, the output of the gate consists mainly of the difference between the input frequencies. To remove any of the sum of the input frequencies that is present, as well as feedthrough of the frequencies themselves, the output of the gate is fed through a 60 MHz low pass filter. Q11 acts as an emitter follower, and the signal is finally fed through another low pass "pi" section before the output jack.

Crystal Oscillators

The schematic of the two crystal oscillators is shown in Figs. 14 and 15. The low frequency oscillator (Fig. 14), consists of untuned FET oscillator Q9, comparator IC27 which produces TTL signal, and TTL dividers IC28 and 29.

The high frequency oscillator, shown in Fig. 15, consists of tuned FET oscillator Q10, and buffer amplifiers A10 and A11.

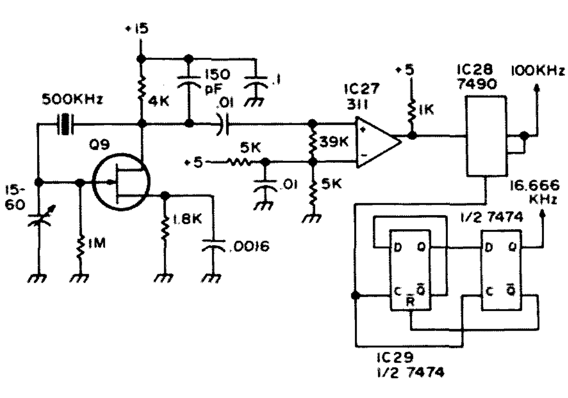


Fig. 14. 100 kHz reference oscillator.

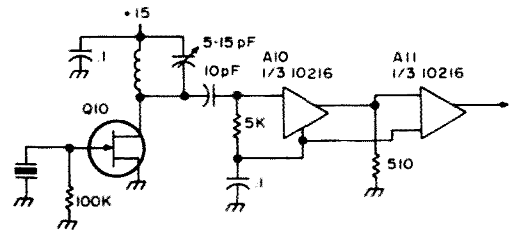


Fig. 15. 16.6833 MHz reference oscillator.

For good stability, ovens should be used for both oscillators.

Power Supply

The circuit of the power supply is shown in Fig. 16. The multiple regulators provide isolation of the sensitive parts of the circuitry from the noisy TTL, and also isolate PLL A from the rest of the circuitry. The regulators used are completely standard, so I won't go into their operation.

Construction

I shall not give complete construction details in this article. The circuit boards and physical arrangement of the prototype were designed around some shielded boxes I happened to have, and the arrangement, while convenient, was not ideal.

However, there are some guidelines which I feel would be useful to anyone designing his own, and these follow.

ECL Connection Techniques

The rise and fall times of the ECL used in the synthesizer are around 1.5 ns, and some care must therefore be taken to reduce crosstalk and ringing.

The ECL gates and amplifiers contain an emitter follower output transistor, but no load resistor. The placement of the load resistor and its value depends upon the length of wire used and its characteristic impedance. Ideally the termination resistor should be placed at the far end of the wire and have a value equal to the characteristic impedance of the wire or transmission line used.

In practice the rules can be simplified a bit. For wires less than 8" in length it is sufficient to use a 510 Ohm resistor placed as near to the terminal end as possible. For longer lines it is easiest to use 50Ω coax terminated in a 50Ω resistor to +3 volts, or the two resistor equivalent thereof shown in Fig. 17.

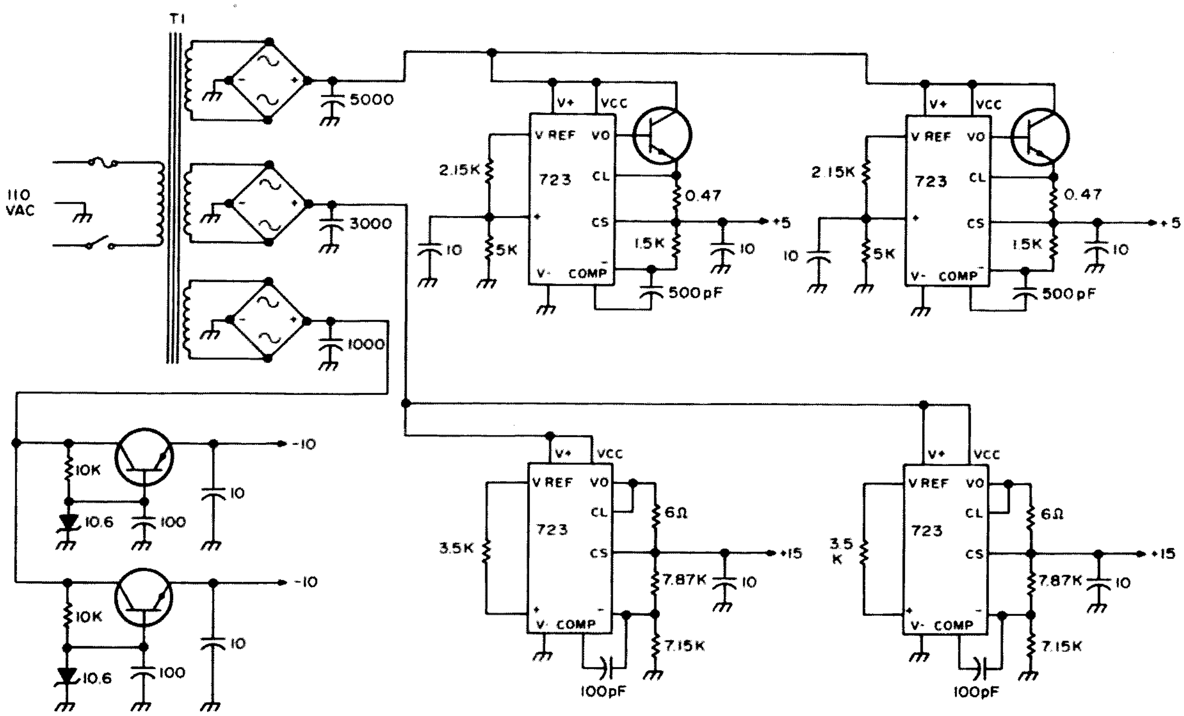


Fig. 16. Power supply.

Shielding

As in any rf generator, shielding is of paramount importance. Any noise which gets into a PLL will cause sidebands. Ground loops, discussed later, are one prime culprit; the other harder-to-deal-with one is electromagnetic coupling between two oscillators in the synthesizer, when they are operating close to harmonics of the same frequency.

Putting each oscillator in a separate shielded box is a must, and the boxes should be isolated from each other by as much distance as possible, with any extra shielding that can conveniently be added.

Ground Loops

Ground loops are feedback paths between different parts of the synthesizer caused by IR drops in a common ground wire. These can be very troublesome, and can easily lead to large sidebands. The best way to eliminate them is to connect each circuit to a central ground through a separate wire. Do not use different points on the chassis as multiple grounds because loops can occur even in a 16 gauge aluminum chassis. Even when a single common ground is used problems can still occur, and it is often helpful to connect various ground points together with a #12 wire to find ways of improving the network.

Power Supply

Care must be taken in the design of the power supply to prevent it from becoming a source of noise or a feedback path. High quality IC regulators should be used along with generous filter capacitors to reduce ripple to a minimum. Separate regulators should be used for noisy circuits like programmable dividers, to isolate them from the sensitive oscillators and phase detectors.

Every single circuit board should be bypassed at least once for every 2-3 ICs, with a 5-30 uF tantalum and/or a .001-.01 uF ceramic disc.

Circuit Boards

The prototype used 18 small printed circuit boards and an Augat wire-wrap board for most of the TTL. The large number of small boards was due to the requirement that they fit into the shielded boxes. The

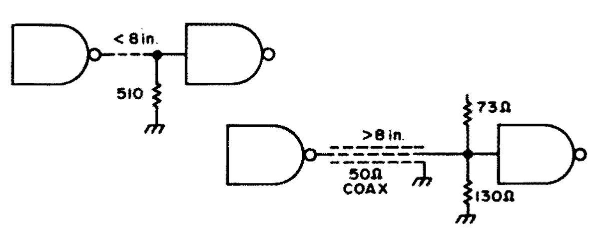


Fig. 17. ECL termination techniques.

wire-wrap board for the TTL was used because it was a great deal easier to make than a circuit board; I highly recommend it.

Uses

The completed synthesizer can be used for a number of things besides a frequency source for transmission or reception. For example, a simple digital control unit can be built to enable the synthesizer to be used as a scanner – like the scanning police receivers, for example.

Or the synthesizer can be used with another control circuit as a response analyser for filters and i-f amplifiers. The response would be displayed as a curve on a scope with precise frequency markers. A small addition to the response analyser turns it into a spectrum analyser with CRT display and precise frequency markers.

The synthesizer can be turned into an FM source by opening PLL C and modulating the VCXO directly. Continuous variation of frequency with no loss of stability can be obtained merely by using a potentiometer to vary the dc bias on the VCXO.

Conclusion

The synthesizer described here is a very complex and expensive project. It may take a month or a year to build, and you can be sure of running into problems along the way.

But once completed, the synthesizer is a joy to use, and can form the heart of such instruments as spectrum and response analysers, which are far too expensive for the amateur to buy, no matter how useful.

The frequency synthesizer, after many years in the position of the impossible dream, is finally coming into its own, and I look forward in the coming years to many new designs, better and more elegant than the one described here.

Semiconductor Parts List

Q1, Q5, Q8, Q9, Q10 – MPF108
Q2 – 2N2369A
Q7, Q6 – MPS-A12
Q11 – MM8001
D1-D0 – MV1401
A1-A12 – MC10216L
IC1, IC24 – M12012L
IC2 – MC12014L
IC3, IC4, IC5, IC17, IC18 – MC4016P
IC6, IC15, IC19, IC29 – 7474
IC7, IC10, IC20 – MC4044P
IC8, IC9, IC21, IC26 – LM318H
IC11 – MC4024P
IC12, IC13, IC28 – 7490
IC14 – 74H30 or 3015
IC16 – 74H04 or 3008
IC22 – MC10104L
IC23, IC27 – LM311H
IC25 – MC12040L
IC30 – MC10107L

Coils

All coils wound on 5/16 Q3 toroid, Indiana General F625-9 Q3
L1 – 3T #20
L2 – ~1 layer #26 solid hook-up closewound
L3 – ~1 layer #26 solid hook-up loosewound
L4 – ~2 layers #28 magnet wire
L5 – 3T #20
L6 – ~2 layers #26 solid hook-up

References

Motorola data sheets for the following:

MC4324 • MC4024
MC4344 • MC4044
MC4361L • MC4016L,P
MC12014
MC12012

Motorola MECL IC Data Book, 3rd ed.
Motorola MECL System Design Handbook

...CALVIN

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A Satellite Fax System You Can Build

Conclusion

The FAX recorder can be built from a wide variety of materials. The ones I used are specified in the line drawings. If you are a machinist, know one, or have the extra cash to hire one, you can obviously turn out a very classy unit. If not, you will scrounge the hardware stores. You should think the whole business out before hand and make sure you have a good solid idea about how the parts should interact. There are a few general guidelines that you should keep in mind:

(1) Assemble the drum, shaft and bearing unit first. The drum should turn absolutely freely; otherwise, re-do it. The mounting of the motor on the mounting plate and the alignment of the plate itself should be done with extreme care so that the drive shaft of the motor is precisely in line with the drum shaft. The two are coupled with stiff rubber tubing. Free movement of the drum and proper alignment of the drive motor are the two most important factors affecting the quality of your final pictures.

(2) The carriage track for the light gun assembly should be precisely parallel to the drum. The width of the track should be adjusted to provide a smooth sliding fit with the piece of wood used for the base of the light gun carriage. A piece of window glass the length of the carriage track, and cut to the width of the space between the rails, is epoxied to the base plate to provide a smooth bearing surface for the light gun carriage.

(3) The wooden pillars of the light gun carriage should be just the length needed to bring the center axis of the light gun tube to

the same height as the center of the drum. Final positioning of the tube on the pillars, prior to epoxying the tube in place, should be done in such a way that the light from the gun comes to a sharp focus on the face of the drum with the lens mounted half-way into the tube. This will provide some range for final focusing once the unit is completely assembled. The hole of the traverse nut should be aligned with the center line of the carriage base, and the mounting plate for the nut should be adjusted so that it is precisely at right angles to this center line.

(4) The mounting of the traverse motor and its mounting plate should be done carefully so that the motor drive shaft is lined up with the center of the carriage track and at the same height as the traverse nut on the light gun carriage. The ¼" -20 threaded rod for the traverse assembly should be straight with smooth threads. Any roughness in the threads of the traverse rod or nut should be eliminated prior to final assembly. Some brands of hardware are better than others, so check them out before you find that there is too much binding for smooth traverse operation.

(5) Standard 1¼" diameter telescope eyepieces can be used in the light gun assembly to focus the light gun output to a small point on the paper wrapped around the drum. The shorter the focal length of the lens the sharper the point of light. This is particularly critical with rolling pin drums because of the smaller image format. The 6mm lens offered by Edmund Scientific is ideal (Cat. #30,204; Edmund Scientific Co., 602 Edscorp Building, Barrington NJ 08007; $4.74 in their 1975 catalog). Such lenses can often be obtained locally, but don't fork out for a premium version; in this application quality is not important. A 10X or better yet a 15X microscope eyepiece can also be used, but such eyepieces have a smaller diameter than those used for telescopes, and an adapter will be required. Again, Edmund comes to the rescue with their Cat. #30,199 ($1.95), a small machined adapter with set screw to convert microscope eyepieces to 1¼" diameter.

(6) The motor reversing switches and the capacitors that come with the synchronous motors can be mounted on the motor mounting plates. Power leads for the motors and the light gun can be routed to connectors on the main chassis where switches can be used to control the on-off functions of these units.

Set Up and Use

The Solid State Module

(1) Connect a frequency counter to the input (pin 1) of IC3.

(2) With S1 in the receive position (1) adjust the 60 pF trimmer capacitor for a frequency of exactly 4.8 MHz. Put it on frequency as close as the resolution of the counter will permit.

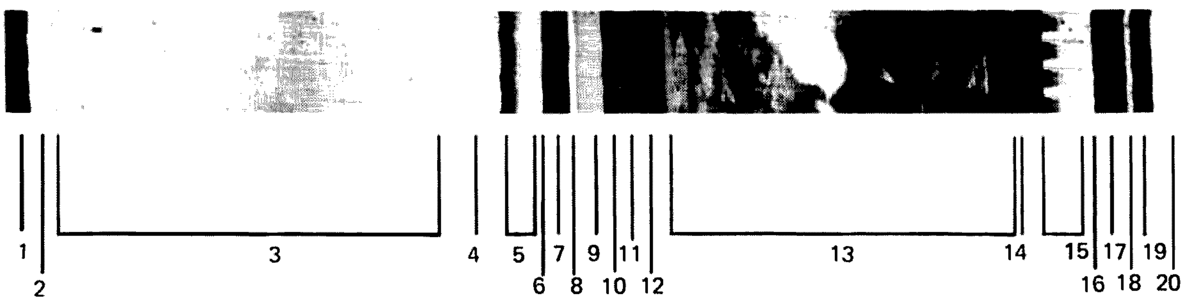
(3) Place S1 in position 2 (display) and adjust the 5k VCO frequency pot near the NE 565 for a frequency of 4700 Hz with S2 open.

(4) With S2 still open check the frequency of the 48 Hz output – with the VCO free running at 4700 Hz the frequency should be 47 Hz.

(5) Switch S1 back to receive and put the counter on output jack A. A frequency of 4800 Hz should be obtained.

(6) Temporarily connect the output of jack A to the input of the 565 (normally connected to the left channel output of the tape deck). Leave S1 in the receive position but connect the counter to pin 4 or 5 of the 565. With S2 open, a frequency of 4700 Hz should be obtained. Closing S2 should result in a shift to 4800 Hz, indicating proper tracking and lockup of the phase locked loop.

Before going on to check out the remaining circuits, it will be necessary to prepare or have available a satellite recording. Any stereo tape deck will suffice. The satellite video should be recorded on the right channel. Set the recorder level for maximum permissible VU meter reading on the noise output of the receiver and you can be assured the satellite video will not exceed this limit. The 4800 Hz reference signal should be recorded on the left channel simultaneously with the satellite video. A 1/4-1/2 scale VU level is entirely adequate for the reference signal as very little output is needed for reliable lockup. The only control that is critical during the receive phase is the position of S1 – it should be set



Line format for the NOAA video signal. Each line at the 48 Hz line rate requires 1250 ms for completion. The sequence shown above was phased to show the sequence as transmitted. Each component is listed below with its duration in milliseconds in parentheses.

1 – pre-earth IR sync pulse (23.31)
2 – pre-earth IR space scan; white (24.47)
3 – IR earth scan (377.78)
4 – post-earth IR space scan; white (61.11)
5 – IR channel grey scale (50)
6 – back porch; white (10)
7 – playback synchronization pulse; black (30)
8 – front porch; white (10)
9 – back scan and overlap allowance; grey (23.23)
10 – sync delay; black (15.1)
11 – pre-earth VIS sync pulse (23.31)
12 – pre-earth VIS space scan; black (24.47)
13 – VIS channel earth scan (377.78)
14 – post-earth VIS space scan; black (61.11)
15 – VIS channel grey scale and telemetry (50)
16 – back porch; white (10)
17 – playback synchronization pulse; black (30)
18 – front porch; white (10)
19 – back scan and overlap allowance (23.23)
20 – sync delay; white (15.1)

For most seasons of the year the modulation levels of the IR and visible channels differ, as shown above, so different gain settings are required for optimum display. The example shown above is for a daylight pass where both IS and VIS data are available. The format for evening passes is identical except that the VIS channel earth scan (13) is black due to insufficient light for operation of the visible light sensor.

to receive (position 1) if the proper reference signal is to be recorded.

The Drum Motor Amplifier

(1) Connect the input of the 565 circuit of the solid state module to the output of the left channel of the tape deck. Place SI in the display position and close S2.

(2) Connect the output of the amplifier to the drum motor and set the 6DQ5 bias pot for -50 V on the pot center arm.

(3) Monitor the ac voltage on the drum motor leads and gradually increase gain at R2. The motor should start to operate somewhere between 80 and 100 V ac, but continue to advance R2 until the motor is running on 120 V ac. Leave R2 in this position.

The Lamp Driver

(1) Open S3 and set R1 for +2.9 V on the center tap of T2.

(2) Plug the R1168 glow modulator cable into the chassis. The tube need not be mounted in the light gun at this time.

(3) With no video input to the 12AU7, close S3 and adjust the black level control for a lamp current of 15 mA. Open S3.

(4) Connect the input of the 12AU7 to the output of T1 and the input of the video filter in the solid state module to the right channel output of the tape deck.

(5) Apply a recorded video signal to the solid state module, close S3, and advance the video gain control of the solid state module. As you watch both the meter in the video amplifier and the meter in the lamp circuit, you will note that video peaks in the solid state module correspond to drops in the lamp current (M2). Increase the video gain to the point where video peaks cause a drop to 1 mA in the lamp current as indicated by M2.

(6) Observe the R1168 glow tube. It should flicker in brightness in response to the applied video signal.

The Facsimile Recorder

Initial setup of the FAX recorder is simply a matter of seeing that the drum turns properly and that the traverse assembly moves the light gun smoothly

along the length of the drum. 110 V 60 Hz ac can be used for both motors in initial testing of the mechanical system. Listen carefully to the drum motor as the drum turns. The motor gear train should make little noise and there should be little variation in noise as the motor operates. Visible hesitation in the drum as it rotates or obvious variations in motor noise output indicate a binding or out-of-alignment condition of the motor and drum, and should be eliminated. A little light oil on the bearings will keep things operating smoothly once basic alignment is achieved. The traverse assembly should move the carriage smoothly in its track. Visible hesitation, jerks or binding will spoil the picture. A small amount of light oil on the traverse screw threads will help. The base of the carriage assembly should be sanded smooth and a small amount of talcum powder can be used as a lubricant on the glass plate of the carriage track. Use very little, as it need hardly be visible to do the job. Too much powder will have the carriage lurching over masses of powder and doing more harm than good. Cycle the reversing switches to verify that the motors will reverse properly. With the layout shown, both motors must run in the same direction for recording a pass; otherwise, the picture will be a mirror image. As viewed from the front of each motor, clockwise rotation is required when the light gun moves from the left end of the drum to the right (viewed from the carriage), while counterclockwise rotation of both motors is required to print a picture in the opposite direction (right to left).

To reduce reflections, paint the inside of the light gun assembly a flat black. The glow tube envelope should also be painted except for a small spot on the top to pass the light from the crater assembly at the tube apex. Adjust the lens of the light gun for sharpest focus on the drum. A blank piece of photographic paper should be wrapped around the drum for this step, as the thickness of the paper is sufficient to throw off the proper focus setting.

Printing The First Picture

The photographic paper used to make the FAX prints needs not be handled in absolute darkness; safelights of certain colors can be used if the paper is not kept too close to the lamp. The initial black current value previously set (15 mA) is based on the use of Kodak Polycontrast Rapid paper, one that is quite sensitive and which will produce pictures of good contrast. An old-fashioned red safelight or the Kodak OC safelight (amber) will not expose the paper if reasonable care is taken. I use two safelights in my basement shack – one near the FAX recorder so I can load paper and watch meters during a run, and the other at the far end of the basement where I actually process the paper. Time and space don't permit a complete description of the proper precautions for handling photographic paper and the details of processing, so if you have had no experience in this area I would seek out a local photo hobbyist or camera shop proprietor for details. All of the steps to be described should be performed in darkness, except for the safelight illumination, unless otherwise noted. I will assume that the satellite recording you have available is a daylight pass containing both visible channel and IR data.

Wrap a piece of 5" x 7" paper around the

Visible channel output from a NOAA-4 pass over the cloud covered central United States on 23 February 1975. The visible channel grey scale and telemetry can be seen on the right margin following the black post-earth space scan.

drum lengthwise with the emulsion facing out. Double sided Scotch tape can be used to fasten the paper in place. The direction of motor rotation (drum and traverse) should be consistent with the direction you plan to move the light gun (see FAX recorder setup). Close the switch to start the drum. The phasing switch on the solid state module should be closed. Turn on the recorder, start the traverse motor and then close S3 to light the glow lamp. After 10 minutes or so have passed, turn off the lamp, traverse motor, recorder and drum, in that order. Remove the paper from the drum and take it to the processing area. I process my papers in Kodak Versatol developer (1 part of the Versatol liquid to 3 parts water) for 1 minute. Rinse the paper in water for a few seconds and transfer to the fixing solution. I use Kodafix fixer (1 part Kodafix to 7 parts water) and fix for 5 minutes. After 1 minute in the fixer the normal room lights can be turned on. What you should see is a photo showing the visible channel, IR channel, and all the intervening telemetry, grey scales, etc. The IR channel will probably be washed out, especially in winter; what we want to look at carefully now is the visible channel.

If the visible channel image looks like that of the photo shown (general range of contrast) you are home free. If it is too dark (the lightest clouds are grey rather than white and the grey scale is not properly displayed), you must reduce the black current slightly and try again. If you reduce black current, also reduce video drive to

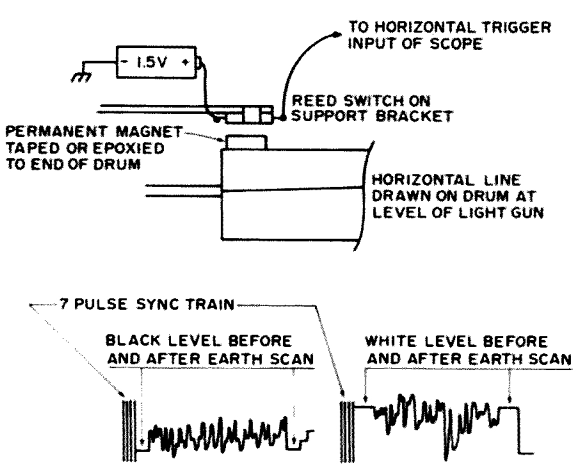


Fig. 7. Circuit additions to provide phasing capability.

maintain a "peak video" indication of 1 mA in the lamp circuit. If the visible channel image is too light we must increase black current and increase video drive. In no case do we want to exceed 20 mA of lamp current – you should be able to print good pictures at between 10 and 15 mA. Make add adjustments in small steps and eventually you will get the black current and drive setting that will produce excellent pictures. Similar adjustments can be made to optimize the IR pictures. Optimal IR settings will change radically according to the season of the year, but a little experimentation will provide good IR display. It is unusual to get good display of both images simultaneously due to differences in the modulation levels employed. The best opportunity for good simultaneous display comes in the summer, when IR video gets as dark (warm) as it is ever going to get.

Picture Phasing

If your drum size requires phasing or you want phasing capability to assure that you never have to repeat a picture, it can be accomplished fairly easily if a triggered scope is available. Fig. 7 shows the additional components required. A small permanent magnet is taped to the drum at one end. A small magnetic reed switch is mounted on a small bracket so that it is closed by the magnet once during each revolution of the drum. A small 1.5 V battery provides a trigger pulse to the scope horizontal circuit each time the switch is closed. Provision should be made to switch the video output of the solid state module to the vertical input of the scope during phasing. With the magnet aligned with the reed switch, mark a line on the drum that is lined up with the light gun. When wrapping paper on the drum, the edge of the paper should be placed on this line. Now, as the drum rotates, the trigger pulse will be produced as the edge of the paper passes the light gun. The insets of the visible channel photo show the proper scope display for phasing either the IR or visible light image. The phasing switch of the solid state module (S2) is opened until the seven pulse sync pulse of either the IR or visible light image is lined up with the left side of the scope

display, at which point S2 should be closed. The video output of the solid state module is then switched back to the lamp driver circuit and you are ready to print the picture. With a little practice, the phasing operation only takes a few seconds.

Relative Advantages of FAX and CRT Display

One of the principal advantages of the FAX system is the low cost of operation when pictures are acquired on a daily basis. "Instant" pictures with the CRT system require the use of Polaroid film, which quickly causes operating costs to soar when used daily.

Instant readout with FAX involves relatively inexpensive photographic paper. The processing time required to obtain the final print is minimal and the print can be viewed just a few minutes after a pass is finished. A disadvantage of the FAX system is that you are locked into a fixed size format determined by the drum size. With the CRT system and 35mm film, it is possible to blow up pictures to any desired size should the scene be worth the effort. I presently use the FAX equipment for my daily file pictures and retake particularly interesting shots using the CRT system so that I can make enlargements later. In addition to the fixed size format, any change in the line rates for a satellite system requires a change in motors. The CRT system on the other hand can readily be designed to accommodate a number of video modes, and a change in line rates can be accomplished inexpensively by simply altering the division chains in the CRT unit.

The CRT display system is vulnerable to one major problem which is common to SSTV display systems as well – unwanted deflection of the scanning line by 60 Hz fields from adjacent power transformers. FAX, involving as it does a completely mechanical scanning system, is not prone to that particular problem. The mechanical nature of FAX does have some drawbacks in that strictly mechanical problems need be attended to, and periodic care and maintainance of the FAX recorder is required to keep it in top operating condition. The all electronic CRT system does not require such care. As a final note, the typical CRT system with its complete and easy control of system contrast usually can provide the best possible resolution of low contrast terrain features which may be harder to see, although they are always present, in the FAX pictures. Intense white cloud features, however, are often washed out in CRT displays because of slight blooming of the CRT trace at high brightness levels. The FAX system excells at retaining fine resolution in very bright cloud structures.

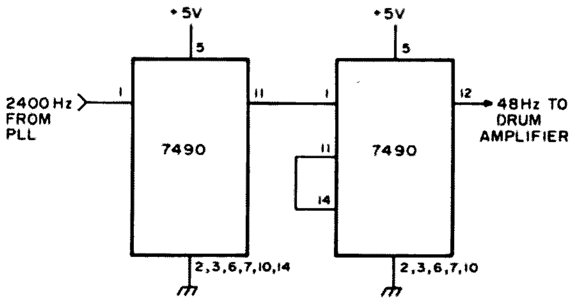


Fig. 8. Additional divider chain for 48 Hz, for use with CRT systems with a 2400 Hz phase locked loop.

As the foregoing discussion should indicate, the best possible solution is to have both systems available in an active satellite station, although either system alone will provide effective performance on a day to day basis.

Adding FAX Capability to an Existing CRT System

The various CRT systems I have previously described in 73 Magazine (Sept. 74, Dec. 74) all utilize a 2400 Hz phase locked loop with appropriate count down chains to derive the trigger rates for APT or DRIR display. The FAX system described here can be added to such a system with very little effort. All that is needed is to provide a new divider chain for the system that will develop 48 Hz to drive the drum amplifier. The logic diagram for such a divider chain is shown in Fig. 8. The High Z video output of any of the previously described systems will drive the lamp driver circuit with no problems. The only provision which must be added for FAX use is that the retrace and line blanking circuit for the CRT video must be disabled when the signal is used to drive the FAX video circuits. In my own system I use center "off" switches in the blanking

NOAA-4 visible channel view of the eastern U.S. on 13 May 1975. The original has a 4 x 6 inch format and was made using a rolling pin drum operating at 96 rpm (120 rpm motor on 48 Hz), with double the normal traverse motor speed for the drum size. Such larger format pictures present excellent resolution while minimizing the need for precision focusing of the light gun. The Great Lakes are visible just above and slightly to the left of the center of the picture.

circuit to accomplish this. If you already have a basic CRT display system with the modifications noted above, simply add the drum amplifier, lamp driver, and FAX recorder, and you are in business with FAX as well. If you plan to utilize just facsimile display, the solid state module described in the present article is your best bet since the circuits are somewhat simpler than those required for a CRT system.

The FAX system described here will provide excellent results with NOAA satellite pictures. If you use a small drum with a relatively small picture format be sure to exercise care in focusing the light gun so you will not lose resolution. With the components specified, even very small pictures should show perfectly clear line structure revealing all the information the satellite pictures have to offer. Larger drum sizes with resulting larger picture formats make focusing less critical, but it should still be done carefully. I will be happy to answer any questions regarding the system, but please provide an SASE if you write.

. . . WB8DQT

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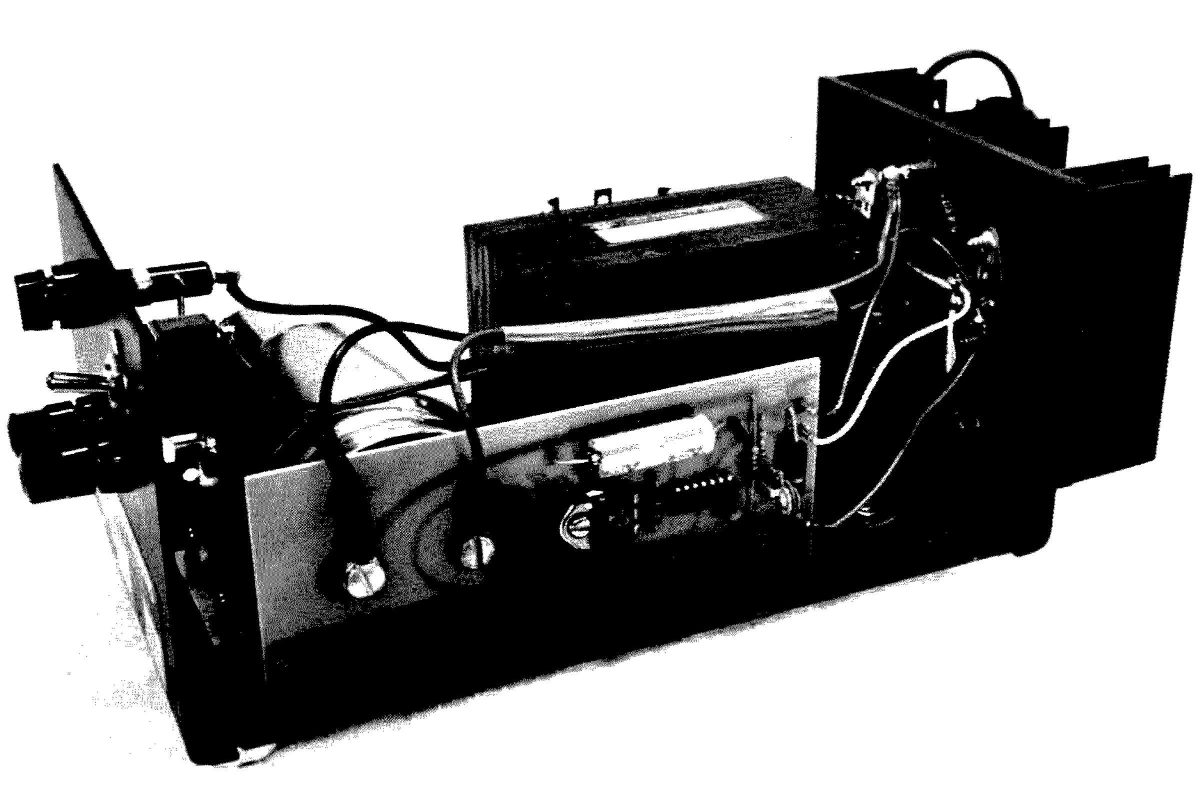
Dispelling the Mystery of Regulated Supplies

Regulated power supplies are a mystery. Almost every IC construction project includes a regulated supply and most amateur solid state equipment built for 117 volts also has a regulated supply or supplies to power the low voltage solid state devices. But the mystery is that while most amateurs have a good idea of how to use transistors and integrated circuits in simple applications, few have the remotest idea of how the regulated supply works and fewer still could design one from scratch if required to. This article is written to dispel the mystery and give the hows and whys of regulated supplies.

This article discusses the operation of regulated power supplies for low voltage applications and gives all the necessary information needed to design a regulated supply from scratch. Information is given so that the designer may select the proper components such as the transformer, diodes,



Typical regulated supply.

capacitor, regulator, pass transistors and heat sinks. References such as those listed at the end of the article will be helpful, but not required, since this article lists all components and gives various alternates so that the designer can design power supplies for various voltage and current combinations. Sources for all parts are given so that the designer won't be stuck for some hard to find parts.

The regulated power supply consists of an unregulated dc power supply feeding a regulating circuit. The unregulated dc supply may consist of a full wave rectifier feeding a filter capacitor as shown in Fig. 1 or it may be a battery used in a mobile or portable installation. The regulating circuit may be a circuit made up of discrete components or it may be a regulating IC, such as the NE550 used in this article. Components and design options are chosen according to the voltage and current requirements of the project needing the regulated supply.

Integrated circuit voltage regulators are commonly used today, rather than discrete components, because of their low cost and ease of use. The basic design in this article comes from the Signetics *Digital, Linear, Mos*[1] manual and is based on the Signetics NE550 regulator IC. This basic design is simple and permits numerous output voltages and limiting currents by merely selecting readily available resistor combinations.

The Dc Power Supply

The dc power supply used for most low voltage power supplies is a capacitive load circuit as shown in Fig. 1. Inductive filters are occasionally used instead of capacitors, but high value, high current inductors are more difficult to locate and more expensive than low voltage high-value capacitors. Either a full wave (Fig. 1) or half wave (Fig. 2) circuit may be used to supply the dc; however, a full wave circuit is preferred because it provides better basic regulation. The full wave circuit is used in this design.

In order to determine the voltage and

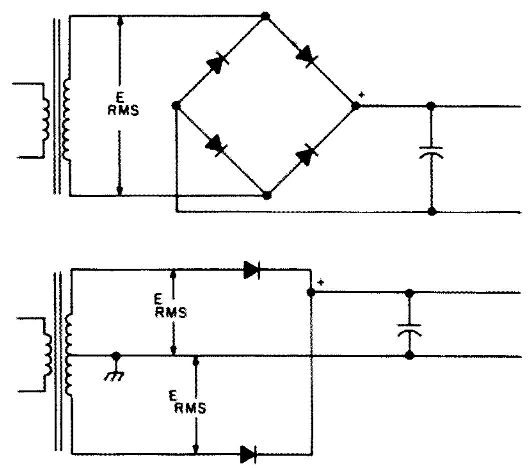


Fig. 1. Full wave circuits. A. Bridge. B. Center tapped transformer.

current ratings of the components to be used in the unregulated dc power supply, it is first necessary to determine the voltage and current requirements of the equipment or device to be powered. When determining these power requirements it is best to allow reasonable safety factors in order to prevent overheating and to insure that the equipment will operate correctly. I normally allow a current safety factor of 10% in cases where I am drawing peak current 50% of the time or less. In all other cases I allow a safety factor of 1/3. (It is better to be conservative the first time!)

To determine the required current rating for the transformer use the formula $I = 1.3 \times I_p$ where I_p is the anticipated peak current requirements of the equipment.

The designer may design the basic unregulated dc power supply so that the dc output voltage is anywhere from 30% to 98% of the peak ac voltage of the transformer. If a large value filter capacitor is used, the 98% value may be achieved and little ripple will appear on the output of the basic supply. Unfortunately, very high-capacitance capacitors are expensive and in some cases may be hard to find. Smaller value capacitors are less expensive and easy to locate but will give lower dc outputs and will produce appreciable ripple on the output. For a given dc output voltage (under load) the ac output of the transformer will have to be higher for small filter capacitors as compared to large value filter capacitors. Note that in general it is less expensive to use a transformer of higher voltage with a low-capacitance

[1] *Digital, Linear, Mos,* Signetics, 1972, p. 6-47.

	1% Resistors		5% Resistors		
E_{reg}	R_A k Ohms	R_B k Ohms	R_A k Ohms	R_B k Ohms	Trimming Resistor
5	6.13	2.97	5.6	2	1k
10	12.3	2.39	11	2	1k
12	14.7	2.31	13	2	2k
13	16.0	2.29	15	2	2k
15	18.4	2.24	16	2	5k
20	24.5	2.18	22	2	5k
30	36.8	2.11	33	2	5k

Table 1.

capacitor for a given dc output than it is to use a large capacitor and a lower voltage transformer to produce the same dc voltage. This is logical since the cost of a transformer does not increase appreciably as the voltage goes up, while the cost of a capacitor increases significantly as the value of capacitance goes up. In order to minimize the cost of the supply, one of the design factors in this article will be to keep the filter capacitor to moderate size and low cost.

Keep in mind that with no load on the output, the dc output from a simple capacitive filter supply will be virtually ripple free. When a load is placed across the supply, ripple will be evident. Further, the amount of ac ripple on the dc output will increase as the size of the filter capacitor decreases (everybody knows that!), but this ac ripple can be significant and not affect the operation of the regulator.

Determining the dc output voltage for a given transformer voltage can be a difficult task if exact values are required. For practical purposes, however, only minimum values, not exact values are needed. For example, if our computations show us that we will get 18 volts dc output from a dc supply, but we really get more than 18 volts, then this is of no consequence. We only want to assure ourselves that we will get at least the minimum required under load. With this in mind, the following formulas[2] can be used to determine the ac (rms) value of the transformer required:

$$E_{peak} = 1.4 \times E_{rms}$$
$$E_{out} = .71 \times E_{peak}$$

Thus $E_{out} = .71 \times 1.4 \times E_{rms}$ where E_{out} is the minimum dc output voltage from the unregulated dc power supply, and E_{rms} is the secondary voltage of the transformer. In summary, the anticipated dc output voltage under load from a simple unregulated supply as shown in Fig. 1 will be equal to or greater than the ac voltage from the secondary of the transformer. (Note: This will only hold true if the current ratings of the transformer are not exceeded.) The above formula takes into consideration that a moderate size capacitor will be used and is based on the assumption that ripple on the dc output voltage can be 10% or less. This assumption is based part on experience and part on charts in the RCA *Solid State Power Circuits*[3] book. (Note that it is not necessary for the average builder to consult this book if the formulas presented in this article are used.) The NE550 regulator IC which is used for the design presented in this article can tolerate 10% ripple provided that the lowest dc input voltage (low part of the ripple) is at least 3 volts higher than the desired dc regulated voltage. Thus, we will have to consider the dc input voltage to be the bottom of the ripple as shown in Fig. 3. Note that the peak voltage cannot be higher than the maximum ratings of the NE550. As defined, $E_{dc\ input} = E_{reg} + 3$, where E_{reg} is the desired regulated voltage. The dc input voltage is also 95% of E_{out} ($E_{dc\ input}$ is 5% lower than E_{out} because of ripple); thus $E_{dc\ in} = .95\ E_{out} = .95\ E_{rms}$. Solving the two equations gives $E_{rms} = (E_{reg} + 3)/.95$. We now have a very simple formula to use to determine the secondary (E_{rms}) value of the transformer given only what we want for a regulated voltage and assuming that we will not exceed the manufacturer's current rating

[2] *Solid State Power Circuits,* RCA, 1971, p. 260. Assumption: $\%RS/RL \leqslant 15$.

[3] *Solid State Power Circuits,* RCA, 1971, p. 260.

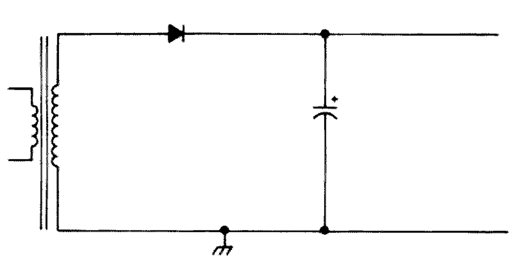


Fig. 2. Half wave circuit.

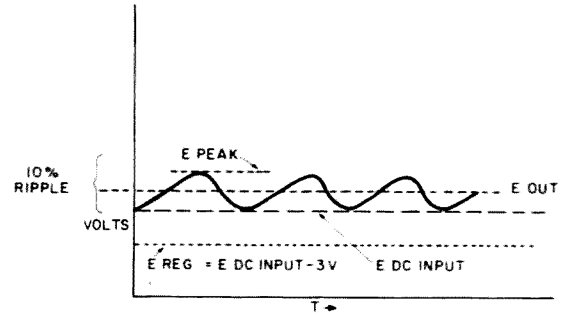


Fig. 3. Ripple on dc output.

for the transformer chosen.

These formulas given for I and E_{rms} will hold true for virtually all low voltage, high current supplies provided that good quality properly designed transformers are selected. The transformers recommended at the end of the article fall into that class. If low grade transformers with high internal resistance are used, then E_{rms} may approach a value of $(E_{reg} + 3)/.5$.

As an example, assume that we want a power supply to deliver 5 Amps at 12 volts regulated. The minimum ratings of the transformer would be determined as follows:

$$I = 1.3 \times I_p = 1.3 \times 5 = 6.5 \text{ Amps}$$

E_{rms} = (12+3)/.95 = 16 volts. Looking through the various catalogues you probably won't find a transformer that has a secondary exactly matching our requirements, but you would find one that exceeds the requirements. Looking at Table 5 we find that Verada in Lowell, Massachusetts, is offering 6.3 V, 6.6 A filament transformers for \$3.75 each or 3 for \$10. Three of these transformers with their secondaries in series (primaries in parallel) (Fig. 4) will give an output of 18.9 volts at 6.6 A at a cost of \$10.00. This is well less than the equivalent single transformer would cost if purchased from an electronic supply house. Thus three Verada transformers are used in this design with an rms secondary voltage of 18.9 volts

It is a good idea to check the peak dc output voltage obtainable under any circumstances to see that this voltage does not exceed the voltage ratings of the NE550 regulator. The maximum voltage is given by $E_{max} = 1.4 \times E_{rms}$. Thus in our case E_{max} = 1.4 x 18.9 = 26.5 volts. The maximum voltage rating of the NE550 is 40 volts. We are within the limits in this case. In a case where E_{reg} is 37 volts, the maximum allowable for the NE550, or any case where E_{max} exceeds 40 volts, then the circuit in Fig. 5 must be used to provide the dc input voltage to the regulator.

Selection of diodes can be made in a fashion similar to the transformer. Diodes in a full wave configuration pass only ½ the total current, thus I_d = ½ I where I_d represents the current requirements of the diodes. In our example, the maximum current is 6.5 Amps, so the diodes would have to handle 3.25 A each. Since this is an oddball value, the next higher current rating would be used such as diodes with a 6 Amp rating. To be conservative for low voltage supplies, the voltage ratings of the diodes should be greater than the maximum peak voltage that can be encountered. For a bridge rectifier configuration, each diode should have a piv (peak inverse voltage) rating of 4 times the E_{rms} value of the transformer secondary, while for a center tapped rectifier configuration the piv should be 6 times the E_{rms} value of the transformer secondary. In our example, diodes in a bridge would have to have a minimum piv rating of 75.6 volts while diodes in the half wave configurations should have a rating of 113 volts. These are oddball values, so we would use diodes of the next higher rating. A bridge with 100 piv rating could be used (Poly Paks 10 A, 100 V bridge) or two diodes in center tapped configuration with a rating of 150 V would do. Note that the current rating for a complete diode bridge (as compared to individual diodes in a bridge) is not divided in half. In this example 6.5 Amps is the requirement, so a 10 A bridge would be required. I prefer diode bridges since they are usually epoxy encapsulated and may be mounted directly to a heat sink without having to worry about

Wattage	Max Current	Minimum dc Current Gain (h_{FE})	Max Voltage	Thermal Derating Factor	Transistor #	Motorola HEP Equivalent
20	2 A dc	25	60	.133 W/°C	MJ2249	HEP241
40	2	25	125	.266	2N5050	HEP241
87.5	4	30	40	.5	MJ480	HEP247
85	4	750	60	.343	MJ4200	–
90	10	20	60	.718	MJE3055	S5001
115	15	20	60	.657	2N3055	HEP704
150	20	500	40	1.2	2N6355	–

Table 2. Transistor selection.

Max. Current	Max. Volts	Maximum Temp. Without Derating	Diode #	
1	200	–	HEP 156	Heat Sink Not Required
2.5	1000	–	HEP 170	Heat Sink Not Required
6	100	100°	1N3880	(HEP 153)
6	200	100°	1N3881	(HEP 153)

Table 3. Diode selection.

mica insulators and special means to provide insulation.

The Filter Capacitor

The filter capacitor smooths the pulsating dc and gives steady state dc with some percentage of ripple on top. I emphasize that fact that there is ripple on top since one of design criteria is that we can tolerate 10% ripple. If the wrong capacitor is chosen, the ripple may exceed 10% (if the capacitor is too small) and the output voltage may be too low causing the regulator to regulate poorly for heavy loads. If the capacitor is too large, the ripple will be smaller and the output voltage from the unregulated supply will be higher, but this is of little consequence to us. Thus, we have to determine the minimum size of the capacitor. Note that excessively large filter capacitors can cause enormously large surge currents through the diodes during turn on. Most silicon diodes can handle large surges for an instant or two so this shouldn't be too much of a problem. If the designer sticks close (50% to 100% larger) to the value of capacitance determined as per this article, problems should not be encountered with popping diodes.

To determine the proper capacitor, it is necessary to first determine the load resistance. This load resistance is determined by the formula $R_{load} = E_{out}/I$, where E_{out} is the output voltage we need from the unregulated dc supply in order to supply E_{reg}. I is the maximum current to be drawn. Note that "load" includes power dissipated in the regulating circuitry. In our example $E_{out} = E_{rms} = 18.9$ volts (theoretical E_{rms} was 16 volts, but we use three transformers to give us 18.9 volts) and I was 6.5 Amps. Thus $R_{load} = 18.9/6.5 = 2.9$ Ohms. The basic formula to be used for the value of the capacitor is $2\pi f R_{load} C=5$, where $\pi = 3.14$ and f = the line frequency. C is the desired capacitance in farads. Solving the equation for C we get $C = 5/(6.28\ f\ R_L)$. In our example the line frequency is 60 Hz and $R_L = 2.9$ Ohms. Thus $C = 5/(6.28 \times 60 \times 2.9) = .0046$ or 4,600 uF. Since 4,600 uF is not a stock value, the next higher value would be used. The voltage rating of the capacitor should be at least double the E_{rms} voltage which in our case is 38 volts.

Some purists may question the 10% tolerable ripple figure previously given. This

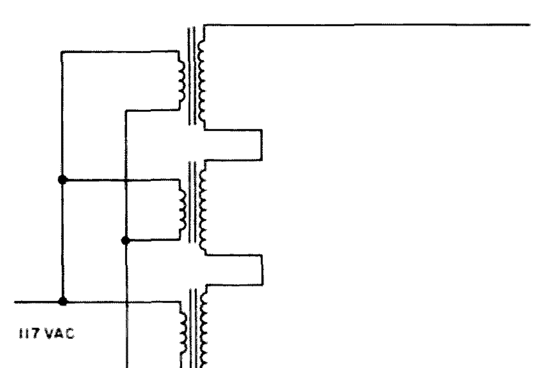


Fig. 4. Three transformers, secondaries in series.

is understandable since for tube type power supplies "no ripple" was tolerable. While this 10% figure may seem like a lot, remember that the only thing that the 550 regulator cares about is that the lowest dc input voltage is at least 3 volts above the regulated output voltage. The amount of ripple on top of this minimum dc input voltage is insignificant as long as maximum ratings are not exceeded.

The Regulator

The NE550 regulator is an operational amplifier with internal reference voltage and current limiting capabilities. The operational amplifier compares an internal standard reference voltage (internal zener) fed into the non-inverting input with a sample of the desired regulated voltage. The difference between the standard voltage and a sample of the regulated output is amplified and inverted producing a control voltage. This control voltage controls a pass transistor which is in series with the regulated output. As the regulated output drops, the control votage increases which in turn causes the regulated output to increase. A stable point is eventually reached where the output voltage remains constant. This stable point depends on the ratio of two resistors (R_A and R_B in Fig. 6) connected as a voltage divider to deliver a sample of the regulated output to the inverting input of the operational amplifier. By changing the ratio of the values of the two resistors, the output of the voltage divider changes which in turn produces a change in the regulated output. The value of the regulated output, thus can be simply changed by altering the ratio of the values of two resistors. Table 1 gives various values of R_A and R_B for selected values of regulated voltage.

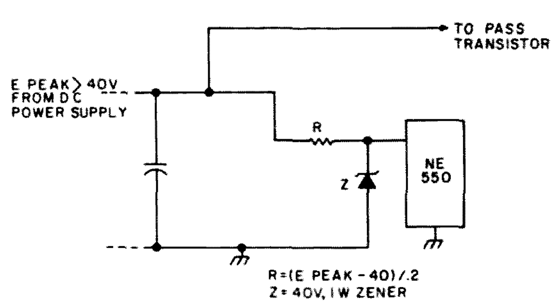


Fig. 5. Regulator protective circuit, E peak 40 V.

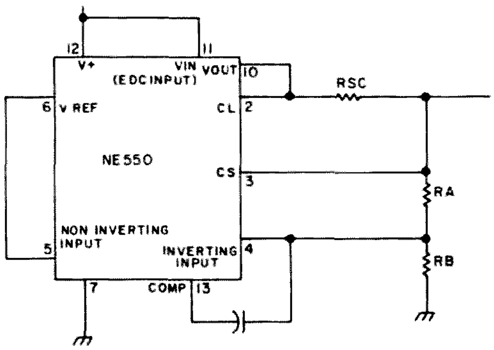


Fig. 6. NE550 regulating circuit.

Current limiting is provided by connecting a current sensing resistor between the base and emitter of a transistor as shown in Fig. 7. When a current through the current sensing resistor reaches the value of I_{lim}, the value of current at which to limit the current, a voltage of .64 volts appears across the emitter-base terminals of the limiting transistor. This limiting transistor starts to conduct and causes the base voltage on an internal pass transistor to be lowered. Since the base voltage of this internal pass transistor is lowered, the output voltage from the regulator is lowered. The output voltage does not drop to zero when I_{lim} is reached, but is merely lowered the right amount needed in order to maintain the output current at I_{lim}. The output current is not shut off but stays at the value of I_{lim}. When the load resistance increases to a point where the output current can fall below I_{lim}, then the output voltage goes back to E_{reg}. This is a very important concept to understand, because if I_{lim} is set at or below the current that the load draws, then regulation will be lost. For example, assume that I_{lim} is set at 6.5 Amps and that the regulated supply was designed for use with a two meter SSB transceiver. The output of the regulated supply is 12 volts and the average current drawn by the SSB transceiver is 4 Amps. An SSB transceiver by its nature can draw very high peaks of current and it is not unreasonable to assume that on current peaks the transceiver might draw 10 Amps of current. On voice peaks with I_{lim} set at 6.5, the current limiting will prevent the SSB transceiver from drawing more than 6.5 Amps. The only way that it can do this is to reduce the output voltage,

MFR	#	Cooling Capacity (Thermal Resistance)
Thermalloy	6111B	10°C/W
"	6176B	4
"	6401B	2.3
"	6403B	1.5
"	6421B	1.0
"	6441B	.54
"	6690B	.28

Table 4. Heat sink selection.

destroying regulation. It is possible that on voice peaks only 6 or 7 volts would be delivered to the transceiver. Low voltage will in most cases adversely affect the operation of any piece of gear and in some cases can cause damage. It is important to understand that *current limiting protects the power supply,* not the equipment. If it is necessary to protect the equipment from low voltage as well as over current, then a detecting circuit must be employed to shut down and latch the voltage off when over current is detected. This type of circuit will be the subject of another article.

To select a given regulated voltage, R_A and R_B must be chosen according to the formulas:

$$R_A = \frac{2000}{1.63} E_{reg}$$

$$R_B = \frac{2000\, E_{reg}}{(E_{reg} - 1.63)}$$

In our example where we want an output voltage of 12 volts:

$$R_A = \frac{2000}{1.63} \times 12 = 14{,}700\Omega$$

$$R_B = \frac{2000 \times 12}{(12 - 1.63)} = 2{,}310\Omega$$

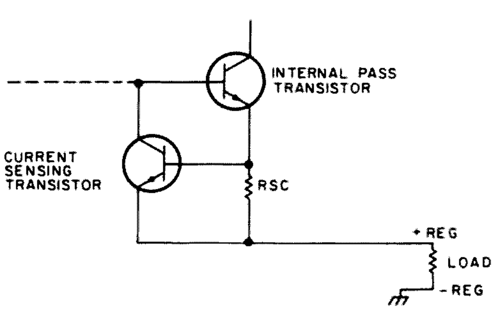


Fig. 7. Current limiting.

The value of the current limiting resistor is determined by the equation $R_{SC} = .64/I_{lim}$ where I_{lim} is the value of current at which to limit. In the power supply in the example, I_{lim} = 6.5 Amps which is the basic design value of the supply. Thus R_{SC} = .64/6.5 = .1 Ohms (approximately).[4]

From a practical standpoint it is not always possible to obtain precision resistors in the values you want without having to resort to ordering from mail order houses. While adjustment of the regulated output voltage may be achieved by using the circuit in Fig. 8 instead of two fixed resistors, the fixed resistors provide convenience and greater reliability over a circuit where a potentiometer may be jarred or mis-set by inexperienced personnel. (Fixed resistors will also keep twiddlers from "increasing the output by increasing the voltage." ZAP!) Five percent tolerance resistors may be used in place of the one percent resistors normally required for precise voltage determination. Table 1 gives the value of 5% resistors to be used for selected voltages. When using 5% resistors, a trimming resistor as shown in Fig. 9 should be used. The value of this trimming resistor is also given. Every power supply could be constructed as shown in Fig. 8 to provide adjustability over the entire range, but it is safer to limit the adjustment to a fraction of the entire range to prevent possible misadjustment into a voltage region which could possibly cause damage to the equipment being powered.

One percent resistors are handy to use when building a batch of supplies since the resistors can be installed without a trimming resistor and adjustment is not required. Table 1 also gives the values of one percent resistors required for selected voltage. These 1% resistors can be obtained from Allied Electronics.

The formulas given for R_A and R_B have been derived for optimum temperature stability of E_{reg}. With very little sacrifice at all in this regard, the basic regulating circuit may be made into a variable voltage regulating supply. Notice that in Table 1 the

[4] .1Ω resistors are available from VHF Engineering. If other low values of R_{SC} are required, use series and parallel combinations of .1Ω resistors to give the desired value.

variation of R_B is small over the range of 10 volts to 40 volts. If we assume that R_B is a constant over that range and that R_A is a variable, we can make a variable voltage supply. Note that we can select a potentiometer to permit voltage variation over the whole range of the device from 2 volts to 37 volts, but the temperature stability at voltages of less than 10 volts will not be as good as the temperature stability in the range above 10 volts. Fig. 8 shows the circuit for a variable voltage supply. One unique thing about variable voltage capability is that the current limit stays the same over the entire range. I_{lim} is not dependent on the value of regulated voltage, but is dependent only on the value of R_{SC}.

It is possible to switch different R_{SC}, current sensing resistors, in and out of the circuit; however, from a practical standpoint problems arise. Switch contacts have resistance (both in a clean and dirty state). This resistance will become a part of R_{SC} and will affect the value of I_{lim}, making I_{lim} smaller as resistance increases. In addition, the contact resistance may vary from one switch cycle to the next causing I_{lim} to vary. A potentiometer conceivably could serve the purpose, but potentiometers also get dirty and very low resistance potentiometers are extremely hard to find.

The basic regulator circuit by itself as shown in Fig. 6 would not handle the current of 6.5 Amps required in our example. The basic circuit would only handle 150 mA. In order to handle additional current, the circuit in Fig. 10 would have to be used. This circuit uses an external pass transistor to control the higher current. This transistor is selected by choosing a transistor with sufficient current carrying capacity and sufficient dc current gain. In our case the current carrying capacity must be 6.5 A minimum. The dc current gain can be obtained from the formula:

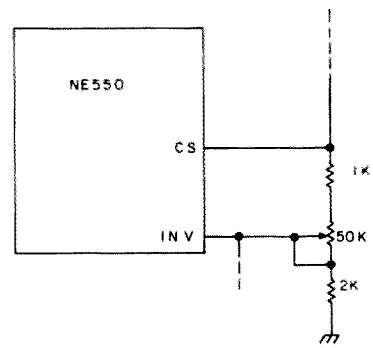


Fig. 8. Variable voltage supply.

$$\text{Current Gain} = \frac{\text{Output Current}}{.15}$$

The dc current gain can be found in Table 2 under the heading h_{FE}. Note that h_{FE} is usually specified for a particular current. This specified current may not be the value as the design current of the supply; thus, h_{FE} is really an approximation for most purposes. This approximation should cause few problems if the transistors in Table 2 are used. In our case the required current carrying capability is 6.5 A and the dc current gain required is given by current gain = 6.5/.15 = 43. Our minimum requirements for a pass transistor would then be 6.5 A and a gain of 43. The voltage rating should be at least 2 x E_{rms}, or 38 volts.

In addition to h_{FE} (dc current gain) and maximum current it is necessary to consider the heat dissipation of the device. The maximum dissipation of the pass transistor under working conditions may be estimated by the formula $P_{dis} = (E_{rms} - E_{reg}) \times I_{lim}$. For the example we are considering P_{dis} = (19-12) x 6.5 = 46 Watts. It is not unreasonable to use a 25% safety factor for the power dissipation, so the required power dissipation for this transistor would be 46 + 1/3 x 46 = 61 Watts. The minimum requirements for our pass transistor would thus be 61 Watts dissipation, 6.5 Amps, h_{FE} of 43, and maximum voltage of 38 volts. To give

Current	Voltage	Distributor	Part #	Approx. Cost
3 A	12.6 V	Radio Shack	273-1511	$4.29
2 A	25.2 V	Radio Shack	273-1512	4.29
6.6 A	6.3 V	Verada		3.75 ea., 3/$10
2.5 A	30 V	M. Weinshenker		4.85
12 A	18 V	VHF Engineering		

Table 5. Transformer selection.

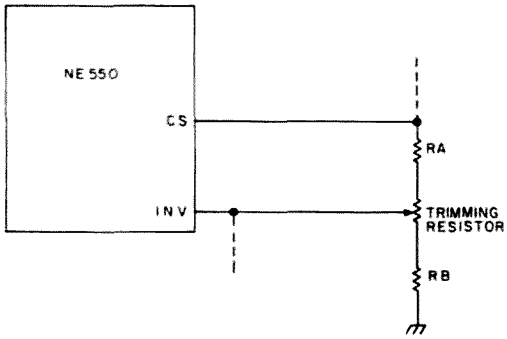


Fig. 9. 5% R_A, R_B with trimming resistor.

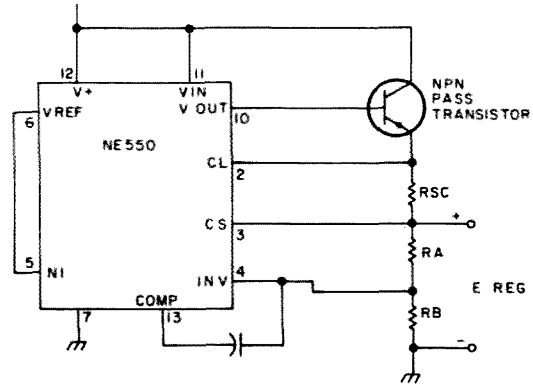


Fig. 10. NE550 driving external pass transistor.

yourself maximum flexibility, a good manual which lists transistor characteristics is handy (but not required). I have been using the Motorola *Semiconductor Data Library* available for $6.50 from Motorola. If you don't have a good book listing transistor characteristics, then you may use Table 2. Using Table 2 we find that a 2N6355 is suitable since it exceeds the specifications needed for this application. The 2N6355 costs less than $4.50, has a dissipation of 150 Watts, 20 Ampere current rating, h_{FE} of 500, and maximum voltage of 40 volts. Note that this transistor is a high gain Darlington transistor and was chosen for the table since it is readily available. It is wise to stay away from transistors with extremely high gains since these "hot" transistors can sometimes go into oscillation all by themselves.

The above calculations assume that the supply will handle intermittent shorts. If the supply must handle continuous shorts, then $P_{dis} = E_{rms}/I_{lim}$. At this point, the power supply design as shown in Fig. 10 is complete except for considering the heat sinking requirements.

Heat Sinking

As everyone knows, semiconductors dissipate heat and in some cases get very hot to the touch. But just how hot can semiconductors get without being destroyed? The data sheets for both diodes and transistors give power derating factors for reducing the allowable dissipation or allowable current for a given temperature rise. These factors must be used to prevent overheating and burnout of the device. Note that a power derating factor is a multiplier based on temperature which serves to lower the power rating as the temperature of the device increases. Table 2 gives derating factors for selected transistors.

Let us assume that in this power supply we used 100 volt, 6 Amp diodes such as the Motorola 1N3880. To determine the power dissipation of the diodes use the empirically derived formula $P_{diode} = I \times 1.5$; thus for our example $P_{diode} = 3.25 \times 1.5 = 5$ Watts (approximately). Furthermore from Table 3 we find that the maximum usable temperature without derating is 100 degrees centigrade.

At this point we must determine the cooling capacity of the heat sink needed. Heat sinks are rated in degrees centigrade per Watt. In other words, for every Watt of dissipation, the temperature of the heat sink will rise so many degrees centigrade above ambient room temperature (23 deg. C). If a given heat sink is rated as 10 degrees C/Watt, then the temperature of the heat sink will

Capacitance	Voltage	Distributor	Approx Cost
1000 uF	25 V	James	$ .75
6100 uF	50 V	Allied	5.00
25,000 uF	40 V	VHF Engineering	

Table 6. Capacitor selection.

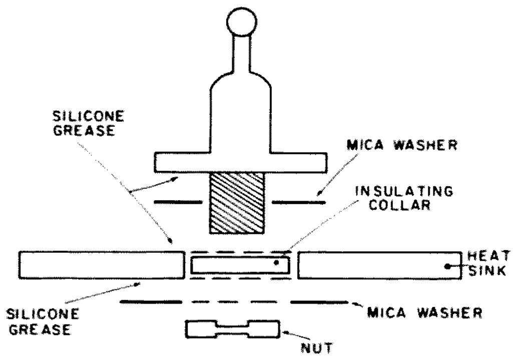


Fig. 11. Mounting diodes to heat sink.

VHF Engineering — Transformers, capacitors, diodes, power supply kits, regulator chips, .1Ω resistors, etc.
Allied Electronics — Transformers, capacitors, diodes, power supply kits, regulator chips .1Ω resistors, etc., 1% precision resistors.
Verada — Transformers.
Poly Paks — Diodes, regulator chips.
Note — Prices and availability will change from time to time. VHF Engineering manufactures power supplies and will sell individual components to experimenters with no minimum order.

Table 7. Additional sources for parts.

rise 10 degrees for every Watt dissipated. The formula for determining the cooling capacity of the heat sink needed is:

$$\text{Cooling cap (deg C/Watt)} = \frac{(\text{max temp - ambient})}{\text{Watts diss.}}$$

From the table, the maximum temperature without derating is 100 deg. C. While our actual dissipation will be 5 Watts, a 25% safety factor applied to 5 Watts gives 6.25 Watts or 7 Watts (rounded upward). Using the formula above, Cooling cap = (100-23)/7 = 11 deg. C/Watt. Table 4 gives various heat sinks selected according to various cooling capacities. As can be seen, the Thermalloy #6111B might be used. This heat sink will produce a temperature rise of 10 degrees C/Watt. When selecting a heat sink keep in mind that the specifications of the heat sink must give *less* heat rise than the device. In other words, the degrees rise/Watt will be smaller or equal to the permissible heat rise of the device. Note that when mounting the diodes to the heat sinks that silicone heat conducting grease should be used on the diodes as well as the mica insulating washers as shown in Fig. 11.

As previously determined the transistor chosen will dissipate 61 Watts under the conditions defined. In order to determine the amount of heat sinking required it is necessary to determine the maximum permissible device temperature rise for a dissipation of 61 Watts, the maximum dissipation that we previously calculated. If you have access to charts, this temperature rise is easy to find. In the absence of charts, the derating factor given in Table 2 is used. The derating factor is a factor that tells us the reduction in wattage which must be applied against the maximum wattage as the temperature rises. For example, for the 2N6355 the derating factor is 1.2 Watts/Deg. C. Thus for every degree centigrade above room temperature, the wattage must be reduced by 1.2 Watts. As the temperature rises, the power dissipation decreases. This factor can be used to determine the maximum permissible device temperature rise. This temperature rise is determined by the formula:

$$\text{Temp rise} = \frac{(\text{maximum wattage} - \text{required wattage})}{\text{derating factor}}$$

Thus in our example, the maximum wattage is 150 Watts, the required wattage dissipation is 61 Watts, the derating factor is 1.2 W/deg.C, and

$$\text{Temp rise} = \frac{150\text{-}61}{1.2} = 74 \text{ degrees rise.}$$

In this case, as long as the temperature of the device does not increase by more than 74 degrees, we will be operating within safe bounds. Note that we are talking about a temperature rise in this case, so in order to use the previous formula we would have to add the ambient room temperature to get the maximum temperature, but then we turn right around and subtract the room temperature. Thus, the previous formula can be modified for cases where we are talking about "temperature rise" as follows:

$$\text{Cooling capacity} = \frac{\text{temperature rise}}{\text{dissipation (Watts)}}$$

In our example we have: Cooling capacity = 74/61 = 1.2 degrees C/Watt. The heat sink

required must have a thermal resistance of less than 1.2 degrees C/Watt. A Thermalloy 6421B with a thermal resistance of 1 degree C/Watt would be a good selection in this application. It is important to use liberal coatings of heat conducting silicone grease on the transistor and associated insulating mica washers.

Summary

It is difficult in a brief article to go into every detail required in order to produce a correct and exact power supply design to fit a driven set of requirements, so the approach that has been taken with this article is to include substantial safety factors so that the analysis and arithmetic could be simplified. The author recognizes that lower rating components could be used, but then exact calculations and extensive analysis would be required. If the experimenter follows the design steps given in this article, the result will be a reliable, moderately priced power supply which most experimenters can easily build.

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Digital Logic - Down Through the Months

Since their inception a few years ago, integrated circuits have had a great impact on the world of electronics. Many new logic types have been introduced, particularly digital, because they allow the designer much greater latitude in his choice of voltage and current levels than do analog devices.

This new technology has brought with it new terms and abbreviations which seem to have left a number of hams confused. In this article I will try to clear up this confusion by reviewing the popular types of IC logic families.

RTL

The first type of IC that came into general usage was resistor transistor logic (RTL). Its basic configuration is shown in Fig. 1. A high at one or both inputs turns on the corresponding input transistor which produces a low at the output.

It should be remembered that the circuits shown are not discrete components but rather are contained on a microscopic piece of silicon.

RTL has several serious shortcomings: (1) slow speed with a maximum of about 10 MHz; (2) low fan out, that is, one output can drive only a few inputs, and (3) poor noise immunity. Because of these deficiencies almost all of the RTL ICs being produced today are for replacement. If you happen to run across any RTL ICs they will probably be from either the 900 or MC700 series.

DTL

Next on the scene was diode transistor logic; its basic gate is shown in Fig. 2. A low at one or more of the inputs forward biases that input diode, causing the diodes connected in series with the transistor base to go into a nonconducting state; the transistor turns off and the output goes high. DTL never was widely used as it soon evolved into an improved type of logic called TTL.

TTL

Before delving into TTL, let's first take a look at transistor switching speed. If we apply 0 volts to the base of a transistor there will be almost no charge carriers in the base and the transistor is off. As we increase the base voltage the number of charge carriers in the base increases and the transistor begins to conduct. Finally we reach saturation where there are a large number of charge carriers in the base, the collector to emitter voltage is very low and the transistor is fully on. Switching speed, then, is determined by how quickly we can get these charge carriers into and out of the base.

Transistor transistor logic is shown in Fig. 3. Its input functions like DTL with the base emitter junctions acting as the input diodes and the base collector junction as the base diodes. The difference arises during turn-off, when the transistor action of Q1 reduces the charge carriers in Q2 more rapidly than would a diode. A further increase in speed

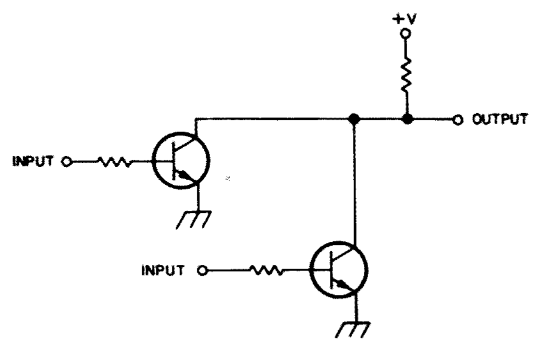

Fig. 1. RTL gate.

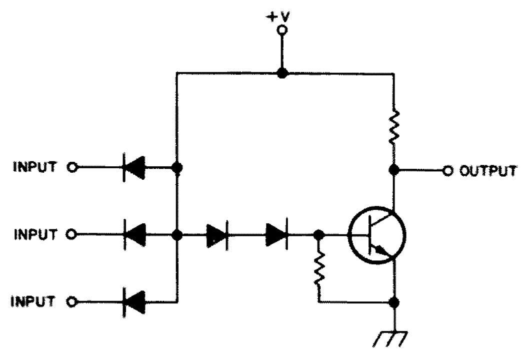

Fig. 2. DTL gate.

results from the totem pole output where the transistors are always in opposite states. These transistors change state whenever the output switches, increasing the turn-on or turn-off current to the next stages.

The maximum speed of TTL is about 15-20 MHz, although selected devices may go higher. Because it is better suited to integration techniques than RTL, the circuit complexity of each IC can be increased.

The 7400 series of TTL ICs are widely available and are the most inexpensive ICs on the market today. One good example of the use of TTL is the K2OAW frequency counter.

Schottky TTL

A Schottky TTL gate is like a standard TTL gate with the exception that each transistor has a Schottky diode connected across it as shown in Fig. 4. This diode reduces the number of charge carriers in the base when the transistor is on. Less time is needed to deplete the base region of carriers and to turn the transistor off. This results in switching speeds of 50 to 60 MHz.

Most Schottky TTL gates are of the 74S00 series. They and DTL are compatible with conventional TTL: No interfacing is needed.

ECL

Emitter coupled logic is the fastest logic available today. It carries the non-saturated idea of Schottky TTL even further. A basic gate is shown in Fig. 5.

An important thing to remember when discussing ECL is that when a transistor is in the active or forward biased region the emitter is about .7 V more negative than the base. A voltage of −1.3 V is applied to the base of Q3, putting it in the active region and making the emitter voltage −2 V (−1.3 V − .7). If the inputs are held to say −1.5 V (low), Q1 and Q2 will both be reverse biased and off. This turns Q4 on producing a low at output 1. Q5 is off and output 2 is high. If we now apply −.7 V to either or both inputs, that input transistor(s) will go into the active region, the emitter voltage will rise to −1.4 V (−.7 − .7) and Q3 is reverse biased, turning it off. Both the outputs will then change state. Note the small voltage swings used: The transistors are off or barely into the active region.

The big advantage in using ECL is speed; rates of over 1 GHz have been obtained. The sacrifice we make for all this speed is power. ECL consumes roughly 3 to 4 times more per gate than TTL. Because of this, ECL use is limited to high speed applications such as large scale computers and frequency counter prescalers. Although rarely available from surplus dealers, the MECL 10000 series is the most common.

MOS

All of the ICs we have discussed so far have used bipolar transistors; let's now look

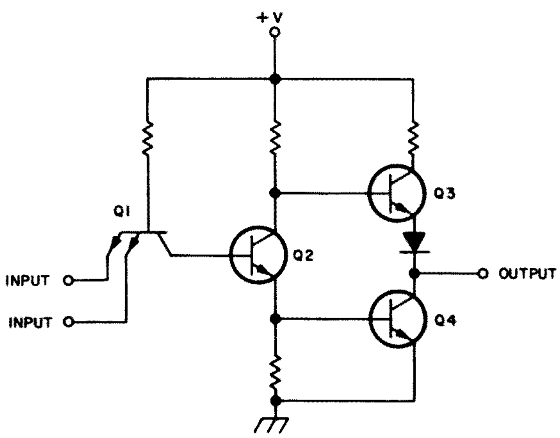

Fig. 3. TTL gate.

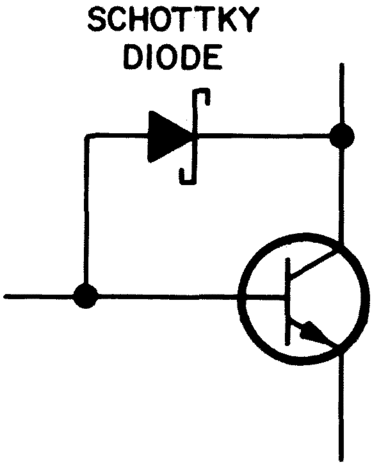

Fig. 4. Transistor with Schottky diode connected across it.

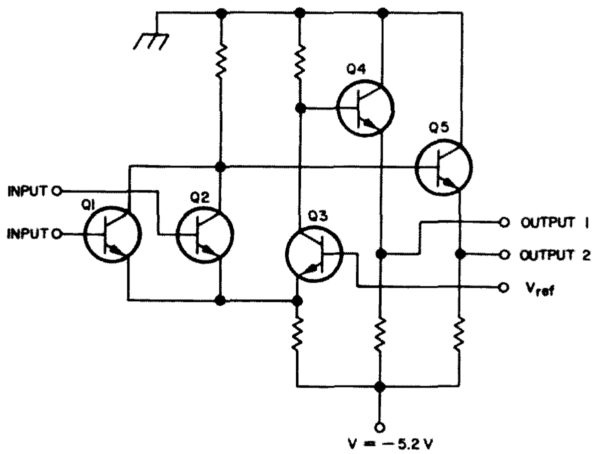

Fig. 5. ECL gate.

at ICs that use MOSFETs (metal oxide semiconductor field effect transistors). In Fig. 6(a) the output is high unless both inputs are high, which pulls the output to ground. In Fig. 6(b) a high at either input turns on the input transistor and grounds the output.

Because of the simplicity of the MOS circuit (only a few transistors are used), and the fact that a MOSFET can be made smaller than a bipolar transistor, MOS's claim to fame is density. Calculators and memories (up to 4k now) are two uses. The 1103 is quite famous as it was the first large (1k) IC memory and made computer manufacturers consider replacing their core memories with ICs. However, the 1103 requires some very critical timing sequences, and should be avoided by the amateur.

MOS also exhibits low power consumption, but its shortcoming is speed, 2 to 5 MHz. That figure, though, is certain to improve with new designs and in fact several manufacturers have announced faster models.

Unless otherwise stated all the large (256 bits or more) memories and shift registers you see advertised in 73 are MOS.

CMOS

Complementary metal oxide semiconductor ICs were originally developed for the military, and since have become very popular in the industrial market. CMOS is slow but uses very little power. As shown in Fig. 7, CMOS contains both N and P channel MOSFETs. A high at the input turns Q2 off and Q1 on, forming a low at the output. With a low input, Q2 is on and Q1 off, resulting in a high at the output. In both cases the resistance between the power supply and ground is very large as Q1 or Q2 is always off. The only time CMOS draws more than negligible power is when it changes state. The low power consumption of CMOS is significant at low frequencies but disappears as speeds of 1 to 2 MHz are reached. The speed of CMOS can reach that of TTL if the gates are deposited on sapphire. Dubbed SOS for silicon on sapphire, this new family has not been produced in large quantities due to cost and the increasing speed of conventional MOS.

The noise immunity of CMOS is excellent. Also, it is unique in that it can operate over a wide range of supply voltages; typically, anywhere from 3 to 15 volts will do.

CMOS comes in three series: 74C00, CD4000, and MC14000. The logical functions of the 74C00 gates match that of TTL 7400 gates, but one type cannot be

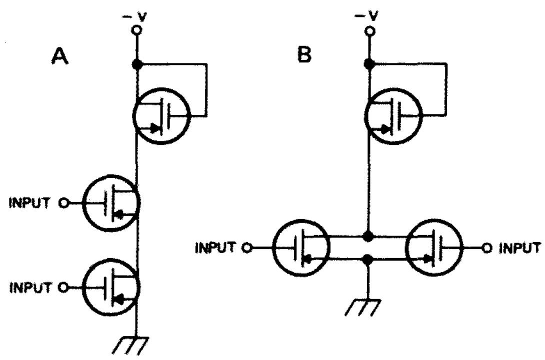

Fig. 6. Two MOS gates.

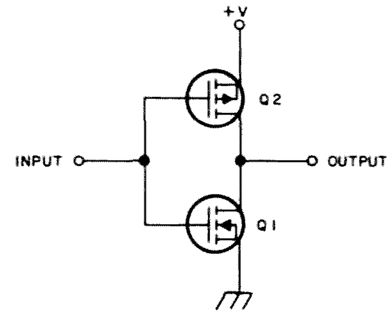

Fig. 7. CMOS inverter.

directly substituted for another. CD40XX and MC140XX ICs are equivalent pin for pin.

Back to Bipolar

It is interesting to note how integrated circuits have caused a complete turnaround in the world of design. During the early days of radio, when vacuum tubes were used, designers tried to keep the number of active elements to an absolute minimum. This held true, though to a lesser extent when transistors appeared. But with ICs, transistors are easy to make and passive elements like resistors are to be avoided. The early IC designs, RTL and TTL, seem to be merely an extension of discrete circuits employing many resistors. Later, MOS was developed using only transistors, resulting in denser and more efficient ICs.

Bipolar designers looked at MOS and found they could apply MOS ideas to their ICs. The first of this new breed of transistor only bipolar ICs is called integrated injection logic (I^2L), which its makers claim has an excellent speed to power consumption ratio. The first uses of I^2L are in microprocessors (brains of a computer) and watch circuits. Also in development are other bipolar types such as C^3L, CHIL and SIL. As they become available, these new bipolar types will probably cause TTL to decline in importance and will replace MOS in many designs.

Integrated circuit technology is still quite young and merits close attention. There are, I am sure, many new developments yet to come.

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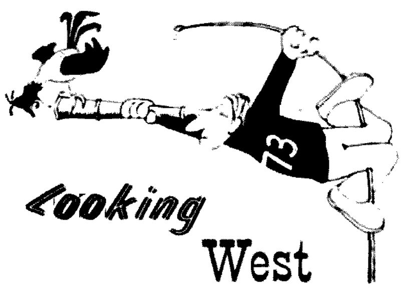
Reference

A Modern VHF Frequency Counter, Peter A. Stark K2OAW, *73*, May, July, September 1972.



Looking West

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Madison Avenue must think that I am some sort of filthy slob, since every other commercial I see on the boob-tube seems geared to convince me that the rest of society will not accept my presence unless I shower with this brand of soap, spray myself with that brand of deodorant and brush my teeth with some super-duper toothpaste. I hate to disillusion all those egos back on Madison Avenue, but though they believe it or not, I think I am a bit more intelligent than the average 10 year old child and do have the ability to decide what I want to purchase without their rather tasteless attempts at convincing me that I am wrong . . . that what they are pitching is far superior to what I prefer. This for me holds true in anything I purchase, be it for my personal use or that of the family.

I judge a product by performance and cost, not by how well some ad agency has done in pitching it. With everything costing more and more each day, I have, like many of you, become a "price buyer"; I look for the best bargain and have found that in many cases the less touted product seems to surpass the more heavily touted one. I guess that this whole thing ends up to me being tired of being bombarded with ad after ad on TV for things that I could care less about, and a rationalization as to why I do what I can to support the public access media — maybe not as much as I wish financially, but at least giving it a plug in this column from time to time. There is nothing on the tube to match the overall creativity that is presented uninterrupted, and, in the field of children's entertainment, I have yet to see anyone else come close to CTW (Children's Television Workshop). If I am going to watch TV for an evening, I far favor the non-commercial kind to the commercial variety. Try it yourself some evening; forego that well touted spectacular with its well touted sponsors for an evening with commercial free television and then let me know how you feel. I know how I feel.

So much for the media soapbox; now back to the amateur radio soapbox and a continuation of where we left off last month, covering events on .76 up until July 9th or 10th. I am happy to report that the malicious interference to WR6ABN has gone bye-bye, but my feelings toward the persons or person responsible for it remain the same: The perpetrators are naught more than malcontents within the amateur radio community and therefore in my mind have forfeited their right to be called "Brother or Sister Ham". I still feel that, for the good of the amateur service, they must be exposed for what they are so that the next person considering such action will think twice. I can hack a lot of tripe, but expanding a bad situation through the use of willful and malicious jamming, expanding a confrontation to include people who are users of a given repeater, in this case WR6ABN, and caring less about what transpires on .76 is a sickening and thoughtless transgression on the rights of ABN's user populace. In a similar vein, the same holds true for WR6AKC, since no matter how you look at it, its sole purpose was to play havoc with AJL. AKC, thankfully, has gone away.

The latest in the situation of WR6AJL itself is that it will continue to operate, but not on .16-.76. While still unconfirmed at this time, the most recent information has it that AJL is vacating .76 and will be moving to 147.75 in/147.15 out; in other words, as a .16/.76 repeater, AJL has failed. More important than the fact that it has failed are the reasons why. While there will be many discussions both on and off the air covering this topic, including many differing views, I rather think that the answer is obvious. It was not the anti-AJL action on the part of the .76 simplex operators or the stand of the SCRA that was responsible, but simply the fact that AJL did not garner the necessary support in user populace that was necessary for it to survive and prosper. If, in fact, it had been able to have its usership multiply quickly, I suspect that it might have been able to prosper, even with all the hell that was thrown up against it. Whether it was because of apathy or just plain uninterest on the part of the Southern California two meter FMers, it never was able to obtain the support necessary in the form of ongoing day-to-day, hour-to-hour usership, and for the moment, the uneasy status quo that was .76 before AJL has returned. But for how long?

True, AJL has failed, but sometime in the future unnecessary confrontations such as this are bound to arise once more. Some other group or individual will get the bug to see that this area does indeed have a .16/.76 and/or a .34/.94 repeater, open for all to use, and again we will go through the same kind of panic situation. That is, unless action is taken now to remedy this situation. Possibly the best remedial action possible would be the establishment of repeaters on one or both of these channels, operated by those parties which have the vested interests in those channels. A .16/.76 repeater operated under the auspices of the simplex users group could serve the purpose of providing repeater type operation when necessary, and, at the same time, .76 could be used for simplex when a repeater was not of a necessity to extend communication range. Use of a lock-out receiver and "quiet hours" for the system during the major morning and evening commute times could write a final "The End" to a situation that will only keep reoccurring as times go on — a situation that only makes enemies out of amateurs who in reality should be friends. No, this idea is not mine; it's more of a summarization of a number of discussions between simplex people that I have listened in on, and in my mind is a reasonable alternative to an ongoing struggle between the relay and non-relay factions of the Southern California FM community. Let's see what the future brings . . .

As you may have noted in reading LW during the past few months, the .16/.76 vs .76 simplex controversy was not the only problem of significance in this area, although it has been by far the most boisterous. If we must discuss problems, and that seems to be the thing these days, then the one of unsanctioned, uncoordinated repeaters deciding to jump an already assigned channel is a definite paramount issue. Simply, even with the inverted split-split channel pairs in use, Southern California is just about out of space on two meters for new systems. Yet, week after week, the SCRA Technical Committee receives applications for frequency coordination on two meters. I don't know the

Continued on page 148

BE MY GUEST

from page 6

HIGGINBOTHAM: I don't believe any of the Commissioners have CB. But we have quite a few employees who have citizens band. It varies from very bad to very good, depending upon where you are and what channels you have to listen on.

BOURNE: *Is the FCC planning on preventing CB dealers from selling Amateur transceivers such as Yaesu that cover 11 meters with over 200 watts to CBers? This is quite a common problem.*

HIGGINBOTHAM: I know it is. I think one of the things that's going to happen is the (FCC's) next step – and I admit that this is not a step I like to take, because I don't think always the answer to solving problems is more rules. But we have so many people who are attempting to find ways to operate outside the intent of the rules that we are going to have to go to type acceptance of amateur equipment. If that happens, I think that Yaesu is going to have to modify its units. I just feel that any standard we adopt (should not allow type-acceptance of) any unit with 11 meter band labeled on it.

BOURNE: *Doesn't type acceptance of amateur radio equipment almost defeat the Amateur Radio Service concept of "building your own equipment"?*

HIGGINBOTHAM: As we envision type acceptance of Amateur equipment, it would be applied only to commercially available Amateur gear. That would be only as manufactured by manufacturers, which permit Amateurs to make changes. I think it would probably mean that you would get better equipment. It probably is going to mean that, for example, some Amateur linears or power amplifiers are going to have filters which will not permit their use on any of the Class D channels. But that may add a little to the cost. I do believe there are a large number of manufacturers out there who build devices and they get by under the fact that they can be sold legally to the Amateur market, but they do not advertise them in legitimate Amateur trade journals. They advertise them in CB journals and truckers' magazines. They do throw in a little caveat, "Not legal on 11 meters," but to me it's just a blatant invitation to citizens banders to buy their equipment, and that's the only market they have. And we're going to clean that up, I'm convinced of it.

BOURNE: *I sure hope so. But what disturbs me most about what is happening on CB is what it's doing to the vital Amateur Radio Service. In other words, the potential Novice is not going into Amateur Radio – he is going into CB because he can just run down to his local (CB equipment store), buy a radio, not even bother getting a license, plug it in, and he's on as a hobbyist. (Using CB as a hobby is illegal, according to Section 95.83(a) (1) of the FCC rules.) In high schools, for example, you no longer find large groups of Amateurs; instead, you find larger groups involved in CB illegally, as a hobby. All over the country, young people are missing out on such a vital hobby (as Amateur Radio), that can trigger their interests toward getting electronics engineering degrees, for example. But all they are learning now is how easy it is to break FCC rules and regulations.*

HIGGINBOTHAM: I know that's a problem. I don't quite know what the answer is. I think it's beyond the realm of possibility to expect us to institute some kind of exam procedure for CB . . . with the large number of applications we are now receiving per month.

BOURNE: *What is it per month now?*

HIGGINBOTHAM: I think last month (May) there were about 190,000 good applications. The month before there were about 140,000. We get over 200,000 pieces of mail in our Gettysburg office every month.

BOURNE: *How much of a backlog is there now in opening mail?*

HIGGINBOTHAM: I think it's about 16 or 17 days. That's too long. We would like to open mail the day we receive it. If we receive a late delivery, open it the next day.

BOURNE: *Do you think establishing a point-of-sale license might clear that up?*

HIGGINBOTHAM: No.

BOURNE: *Are you planning on pursuing that any further?*

HIGGINBOTHAM: We would like to have some sort of a procedure that would permit an off-the-shelf type customer to begin operation quickly, if we can. That kind of a procedure, whether you call it point-of-sale or some kind of conditional or interim license, will not solve our application backlog, because applications will still have to come in and will still have to be processed. That can only be solved by manpower in our present state. We feel that we made a lot of changes; we've reduced, almost an irreducible minimum, the amount of information we ask for on applications. At the present time, we get out of our processing staff about 50,000 applications per man year of effort. That means an average application is in an examiner's hands about two minutes. We are still looking at other procedures we can utilize to update efficiency, but I don't think that we are going to be able to make a real dent there. So we have two separate problems. One of them, giving someone an immediate operating authority, is a public-service type of thing. We think it's in the public interest to serve people quickly who want to be licensed. On the other side of it, the manpower is related to that, but I don't think it's very realistic to gear up enough people to process 200,000 applications a month, on a two- or three-day turnaround basis, which would be highly desirable.

BOURNE: *Jumping back to ATIS – since that would use an ASCII-type of transmission system which you would have to monitor, are there any plans to further the allowance of ASCII on Amateur Radio for radioteletype transmissions? The Commission denied a request a few years ago for ASCII privileges, due to the fact that it could not justify to the public the purchase of monitoring equipment for ASCII transmissions from Amateurs.*

But now that ATIS might be established with ASCII, and the Commission therefore would have to have ASCII monitors, this reason would no longer be valid. So are there any plans to allow this?

HIGGINBOTHAM: I think we may have a petition renewing that request. (The American Radio Relay League recently submitted such a petition.) We are going to have to take another look at that. As I envision ATIS, if we get ATIS, we are insisting upon a standardized system on the theory that we would have a standardized readout device. It would probably be a Nixie-tube or LED display type of unit which is designed to work on just the call letter. You might also have to include provision to handle the unit number because, if we go to ATIS, I'm sure that users will want, in addition to call letters, a unit identifier. I think, in the case of Amateur Radio, that that turndown was based upon our inability to monitor the text. I don't think that's going to be changed by ATIS. It will have limited digital readout capabilities. I would assume that we are going to have to have those devices specially built, initially.

BOURNE: *ASCII, if it's done correctly, would not take up any additional bandwidth, and would allow for much more experimentation on Amateur Radio, which is what the service is all about.*

HIGGINBOTHAM: I'm not really that hung-up on prohibition of ASCII . . . (just because) we cannot decode the text. As a practical matter, if you really want to read it, you can record it; it's laborious, but you can do it manually.

BOURNE: *On the RACES docket, is anything going to happen in the near future?*

HIGGINBOTHAM: If you looked at any of the comments, I think you would appreciate it was a touchy proposal. I had one serious concern about it. I think that there has been a widespread growth of abuses of Amateur Radio by local governments, in their desire to get additional Local Government facilities, that has nothing to do with RACES programs. That concerns me, because I think that when that happens the Amateur community has been had. I think the Commission has not been dealt with fairly. That's been sort of held up. The chief of that branch has been vacant since John Johnston left it. We've been trying to find someone and it was recently posted. I think when we get that job finished this fall, we will pick up the RACES rule-making and do something with it. Meanwhile, I consider some of the other items to be of more immediate importance, such as crossbanding rulemaking, and the matter of assignment of two-letter calls to the Extra Class. I think those matters will be addressed before we get to RACES.

BOURNE: *Is your staff up to full capacity now, in all the various branches?*

HIGGINBOTHAM: No. We are understaffed in a number of areas, but at the moment we are about, I think, one over our year-end ceiling. We have a normal employment level and a year-end ceiling level. At the moment, Amateur and Citizens is one position low, and the rest of our divisions are staffed at current authorized strength. We have one that is two over.

BOURNE: *Do you think that Class E CB will really take hold, considering*

(the relative inactivity of) Class A on 460 MHz? Why would CBers suddenly want to go on 220 MHz FM? There is no long-distance "skip" to work there, that they are working illegally on 11 meters.

HIGGINBOTHAM: The same thing that has made Amateur repeaters go, on 2 meters. I think that there will be widespread multichannel equipment available at reasonable prices. I feel that if we have Class E there has to be some provision for repeaters.

BOURNE: *Who would run these repeaters?*

HIGGINBOTHAM: That raises a question as to how we would do it. They may be somewhat like the SMRs (Specialized Mobile Radio carriers) that we are talking about in Docket 18262. Or they may be club-type operations. I would think it could be done by clubs of CBers.

BOURNE: *But clubs are virtually groups of hobbyists. In other words, why would a CB group even form, since CB is supposed to be used as a tool? Can you really trust a group of hobbyists which shouldn't even exist in the first place to run a repeater legally? Or shouldn't it be some other type of setup, maybe even a new commercial service established to run repeaters for CB?*

HIGGINBOTHAM: Well, perhaps. One of the things that bothers me a little bit there would be creating something that might be regulated as a common carrier. Traditionally, that, in my opinion, hasn't worked all that well. It's beset with applications to deny, protests, and so on. Of course, we would envision there a shared service with no protection, so maybe it could work.

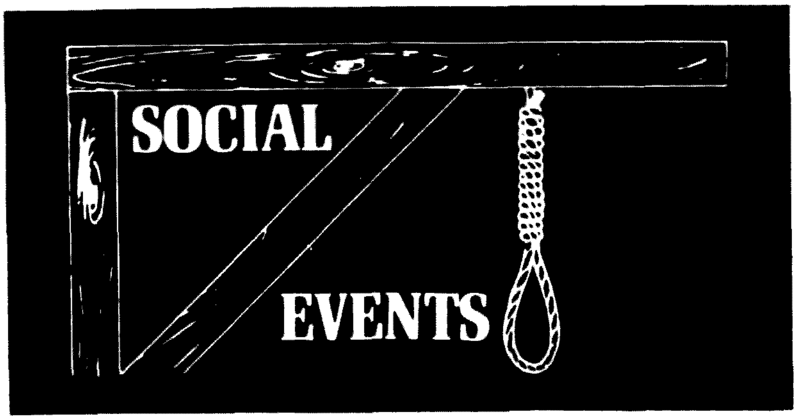
BOURNE: *Or do you think there might be so many takers for the new Communicator (proposed code-free class of Amateur) license, if this goes through, that there won't even be any need for Class E?*

HIGGINBOTHAM: That's one of the things we said we wanted to evaluate. My guess would be that we are not going to have a flood of Communicator licensees. I've heard at Amateur meetings someone walk around and say, "Count to three." When a person says, "Three," they say, "You've just passed the test for your Communicator license." The fact that we say "no-code Amateur" doesn't mean that we are not going to insist upon some sort of an examination to show knowledge in regulatory and operational and technical aspects of use of radio.

BOURNE: *What are some other current projects that you are working on?*

HIGGINBOTHAM: In Amateur and Citizens, we are very seriously considering handling Docket 20120 — CB expansion — in two parts. The first Report and Order will address the AM-versus-sideband issue, because we feel there are a lot of users that have to be told what we're going to do. We need to do something about changing the inter/intrastation designation. I think we are going to drop all designations of inter/intra frequencies. We will retain the emergency channel. The second part would be the availability of additional channels. Because we do have neighbors on the north and south of us, who are operating in the same band, I don't feel that we can go to a Report and Order until we work

Continued on page 144



OTTAWA ONTARIO
OCT 3-5

The 1975 Radio Society of Ontario Convention, hosted by the Ottawa Amateur Radio Club, will be held at the Skyline Hotel, Ottawa on October 3, 4 and 5, 1975. Programs include: 9 technical forums (including W2NSD/1, 73 Magazine's Wayne Green), commercial exhibits, flea market, technical displays, C.R.C. satellite display, major drawings and door prizes, and much more. The Skyline Hotel is located within walking distance of Parliament Hill, National Arts Centre, the Royal Canadian Mint and in a major shopping area.

EAST RUTHERFORD NJ
OCT 4

The Knight Raiders VHF Club's auction and flea market will be held on Saturday, October 4th, at St. Joseph's Church of East Rutherford, Hackensack Street, East Rutherford. Free admission, free parking, refreshments available. Talk-in will be on 146.52 and 146.94. Flea market tables: $5 for full table, $3 for half table. Reserve your tables in advance by writing to The Knight Raiders VHF Club, Inc., K2DEL, P.O. Box 1054, Passaic, New Jersey 07055.

WAKEFIELD MA
OCT 4

Quannapowitt Radio Association annual auction, greatest and oldest in N.E., Saturday, October 4th, St. Joseph's Parish Hall, Wakefield, Massachusetts, 10 am to 4 pm, doors open 9 am, 10% commission, no minimum. Door prizes, special prizes. Talk-in 146.52.

MEMPHIS TN
OCT 4-5

Memphis is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, October 4 and 5. Demonstrations, displays, MARS meetings, flea market, prizes. Talk-in on 3980, .34-.94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis TN 38127 or telephone 901 358-5707.

WARRINGTON PA
OCT 5

The Mt. Airy VHF Radio Club (the Packrats) are holding "Hamarama 75" at the Bucks County Drive-In Theater, Route 611 (Easton Rd), Warrington, Pa., on Sunday, 5 October 1975, 8 am to 4 pm. Registration $1.00, tailgating $2 — bring your own table. Parking for 1000 cars. Talk-in via W3CCX/3 on 52.525, 146.52 and 222.98/224.58 MHz. For information contact Lee Cohen K3MXM, 8242 Brookside Rd, Elkins Park, Pa. 19117. Phone (215) ME5-4942.

CEDAR RAPIDS IA
OCT 5

Cedar Valley ARC Hamfest. Commercial displays welcome. Advance tickets $1.50. Prizes are Icom 22A, Wilson HT, Collins 30L1 power amp, Cushcraft beams and many more. Overnight camping permitted. Talk-in 146.16/76,146.94 and 3.97 MHz. Advance reservations CVARC, Russ Boone, PO Box 994, Cedar Rapids IA 52401, (319) 393-1080 after 5 pm.

LEAGUE CITY TX
OCT 5

The Tidelands Amateur Radio Society's annual hamfest is Sunday, October 5, 1975, 9 a.m. 'til-? at the Galveston County Park, League City. Advance registration $1.50; $2 at door. Free parking, refreshments available. Main drawing for door prizes will be at 3:00 p.m. Swap booths available. For information, send a S.A.S.E. to Luke Sterling, 105 Seabreeze Drive, League City, Texas 77573.

NUTLEY NJ
OCT 6

The Nutley Amateur Radio Society will again conduct classes in Morse code and basic electricity and radio theory for prospective Novice class amateur radio operators. The first class will be held on Monday, October 6, 7:00 pm, in the Nutley Red Cross Building, 169 Chestnut Street, Nutley NJ. Interested persons should write to the Society or telephone the president, Noel Scheffen WB2LDN, at 201-661-2057.

PARMA OH
OCT 10

The Parma Radio Club of Parma, Ohio, suburb of Cleveland, will hold its first fall flea market on October 10, 1975. The time is 8 pm to 10:30 pm. The location is in the basement of the Cardinal Savings and Loan building, 5839 Ridge Road, Parma. The club is requesting a donation of $1.50 per person at the door. (Children under 12 free.) For more information contact John Thomas WB8JSC, President PRC, 3110 Grantwood Drive, Parma OH 44134.

COLUMBUS OH
OCT 10-11

On October 10 and 11, 1975, the ARRL Great Lakes Division Convention will be held in Columbus, Ohio. The actual site is on the north side of the Ohio State Fairgrounds just off 17th Avenue. There will be a number of well-known personalities among the amateur radio fraternity there both as guests and as speakers. For more information contact: Ira Bickham, Chairman, Industrial Displays, 1423 Thurell Road, Columbus, Ohio 43229.

SYRACUSE NY
OCT 11

The eleventh annual Radio amateurs of Greater Syracuse Hamfest will be Saturday, October 11, 1975, 9 am to 6 pm at the Syracuse Auto Auction, 4 miles south of Syracuse on U.S. Route 11 between Nedrow and LaFayette, New York. Exhibitors, flea market, CW and Wiring Contests,

speakers, forums, panels and eyeball QSOs. Lunch counter, nearby campsite and Apple Festival for whole family. Talk-in on 31/91. Donation $2 at door – before October 1st $1.50. For more information contact Allan WA2UBT, 128 Atkinson Avenue, Syracuse, New York 13207.

WASECA MN
OCT 11

The 5th Annual Southern Minnesota Swapfest will be held on October 11, 1975 at the Waseca Community High School beginning at 9 am. It is southern Minnesota's largest hamfest. For more info contact VARS, Box 3, Waseca, Minnesota 56093. Sellers bring your own tables.

MITCHELL IN
OCT 12

The Spring Mill Hamfest will be held on Sunday, October 12, 1975 at Spring Mill State Park in Mitchell, Indiana with Hoosier Hills Ham Club, Inc. Flea market, IPON, IRCC, ITN. Major prize: Drake TR-4C, second prize: Drake TR-22C, pre-registration prize: TR-22C, bonus registration prize: TR-22C. Gus Grissom Memorial, plenty of playground and Bingo for XYLs & YLs. All registrations $2; State Park admission extra. Send your advance registrations to Hoosier Hills Ham Club, P.O. Box 375, Bedford IN 47421.

STOUGHTON MA
OCT 12

The Minute Man Radio Assoc. (M.M.R.A.) of Eastern Massachusetts will hold their annual auction Sunday, October 12, 1975 at Stoughton High School in Stoughton, Mass. at 12:30 pm. This event is rapidly becoming the largest of its kind in the area. Three skilled auctioneers will preside. Excellent prizes, quality food and snacks. Everyone welcome.

LIMA OH
OCT 12

The Northwest Ohio Amateur Radio Club Inc., will hold its Hamfest October 12, 1975 at the Allen County Fairgrounds in Lima, Ohio. 150 inside tables, manufacturer's displays, door prizes, dealer tables and free camping space Saturday night. Tickets advance $1.50 – gate $2.00. Talk-in 52/52, 94/94, rptr. 07/67. For reservations tickets, write: NOARC, PO Box 211, Lima OH 45802.

GAITHERSBURG MD
OCT 19

The Foundation for Amateur Radio will hold its annual hamfest at the Gaithersburg Fairgrounds, Gaithersburg MD on Sunday October 19, 1975. Featured is large flea market, food service, exhibits, ladies events, supervised children's program, and many prizes. Main events are all indoors. Picnic grounds and free parking available; will be held rain or shine; participation fee is $1.50; sales space $5.00; talk-in service provided; nearby motel rooms available. For information write or call Bill Miller K4MM; 10919 Woodfair Road, Fairfax Station VA 22039; telephone (703) 978-4020.

VENTURA CA
OCT 24-26

The South Western Division Convention will be held October 24-26, 1975 in Ventura, California. It will be a fun filled weekend with technical sessions, exhibits, contests, banquet, prizes, ladies' program and no host cocktail party. The convention will be held at the Ventura County Fair Grounds, with the new Holiday Inn, just two blocks away, as the convention headquarters.

The convention rates will be $18 single, $24 double, $40 suites. The Holiday Inn, P.O. Box 1628, Ventura CA 93001.

HARTFORD CT
NOV 1-2

The 1975 New England Division ARRL Convention will be held at the Hartford (CT) Sheraton and Civic Center, November 1-2. For exhibit space contact Carleton Dane W1FXK, PO Box 431, Canton CT 06019.

additions and ~~corrections~~ *corrections*

"How About a Weather Satellite Monitor?", WB8DQT, August, 1975, p. 45.

The IC numbers were wrong in the caption for Fig. 1. IC9 is a 74121 and IC10 is a 741 op amp. The correct data was in the parts layout.

***

Being the author of *How to Compact Multiband Dipoles* (August, 1975, p. 80), I am getting piles of mail concerning a misprint of the antenna dimension data.

Under "Antenna Dimensions," Dipole A, the leg dimensions should read as follows:

About 35'6" of wire, coil, approx. 5' of wire.

I urge people to use the published formulae to determine precise wire length values.

Peter Fischer VE3GSP
1379 Forest Glade Road
Oakville, Ontario

***

Associate Peter Stark K2OAW notes that, in our August article entitled "Surveying the DVM Scene" (page 42), we omitted several good DVMs. Here they are. - Ed.

Manufacturer	Model	Price	Wired/Kit	Pwr Source	Digits Disp.
Micronta (Radio Shack)	22–200	$119.95	W	AC/DC	3½
Non-Linear Systems	LM–3	99.95	W	DC	3
B–K Precision	280	99.95	W	DC/AC*	3

*Optional at added cost.

J. K. Bach
Ivy Hill Road
Walden NY 12586

Megger for Peanuts

It was back in WW II days. My landlady, Gladys, had these goldfish in a big aquarium, a husband Al, a two-year-old Carol and a cat. She had noticed an attrition in the goldfish population which she attributed to the feline. She was, however, realist enough to suspect her baby daughter too. As the resident electronics expert, could I invent something that would determine guilt or repel – without harm – the culprit?

I gave this some thought. The basic scheme was to connect the light line between a ground screen (you could get galvanized iron screen in those days) and the water itself. The fish and the pipes would probably ionize the water enough.

Obvious enough, but there remained safety considerations. The kid was a card, and definitely not expendable. Limiting resistances, sure, but how big? I had heard 15 mA put forth as the least amount of current, applied directly across the heart, that would be fatal. I remembered the story I read that in. As a writer, I had utterly no faith in it. For one thing, it stated an unique value, not a range. Human beings vary at least three to one in susceptibility to inimical influences, whether electric, ballistic, chemical or a knock in the head. Taking 15 mA as a point to depart a long way from, a megohm in one side of the line seemed like a conservative place to start. But the direct other side – how could I make sure the other side stayed grounded? Simple: duck the problem, put a meg in each side.

Feeling a little silly, I tested the system, while Gladys and the goldfish watched curiously. Like all old radiomen, I'm a sissy about high voltage. Back then, about once a week, I'd get the charge from the coupling capacitors while changing coils in the big transmitters on the hill (Lawrenceville). This taught me to watch what I was doing and strengthened my vocabulary.

I didn't expect to feel much, considering the "decoupling" resistors. But I did expect to feel something, if only a tiny tingle. But still thinking of the baby, I decided to leave the setup alone for a few days before dropping resistance values.

Gladys counted her herd every day, and gave me the unchanging total each day at the supper table. Come Saturday night, with the baby in bed, Al got out the bottle and

poured us all drinks. Along with a host of other things, we discussed the goldfish and decided the cat was making fools of us. We weren't drunk, but neither were we sober enough to pass up an experiment. Al caught the cat and gave her to me. Kitty didn't know what was coming, but she suspected she wasn't going to like it.

Taking her firmly by the neck, I pushed her head so that her nose would barely touch the surface of the water. At the exact instant of contact, she jerked. I tried it several times. I can't tell a microsecond any better than anyone else, but it seemed to me that here was biological-electrical rather than nerve response.

Gladys said, "Aw, the *poor* kitty—", took her from me and shoved her whole face under the water. The cat exploded out of her arms and escaped. Puzzled, I dipped my finger in again, contacting the ground screen with my other hand. If I got hit, I'd at least fall clear. Nothing. I was conscious of my audience — Al, Gladys, and the fish. I stuck my own nose in the water. Nothing. I stuck my tongue in the water and the fish backed away. Nothing. Not even the coppery taste you get from a dry cell.

We concluded that the setup was working, though it was hard to see how. Obviously, the cat had a horror of that tank. Cats smell very well, though their noses are isotropic. They often miss a bit of food within reach, while a dog scans, goes into a hunt, and locks on in practically one motion. But maybe we had an entirely new biological phenomenon here. Was a cat's nose a supersensitive indicator of an electrical charge? It certainly seemed so.

Maybe I'd go down in history as the discoverer of something called "The Kitty Effect," or an even more objectionable alternative. We all had another drink, and one of us wondered what an observer who didn't know the situation would have thought of our antics. This broke us up, and we went to bed, giggling.

From this, I did learn a little. The limiting effect of a resistance is instantaneous. The system was a big voltage divider, and the better the contact, the less voltage drop.

I forgot all this for twenty years. I wound up on a microwave test bench, and found out a lot of other things. You've heard of the Miller Effect? Ever see any evidence of it? I did. The 70 meg i-fs would occasionally

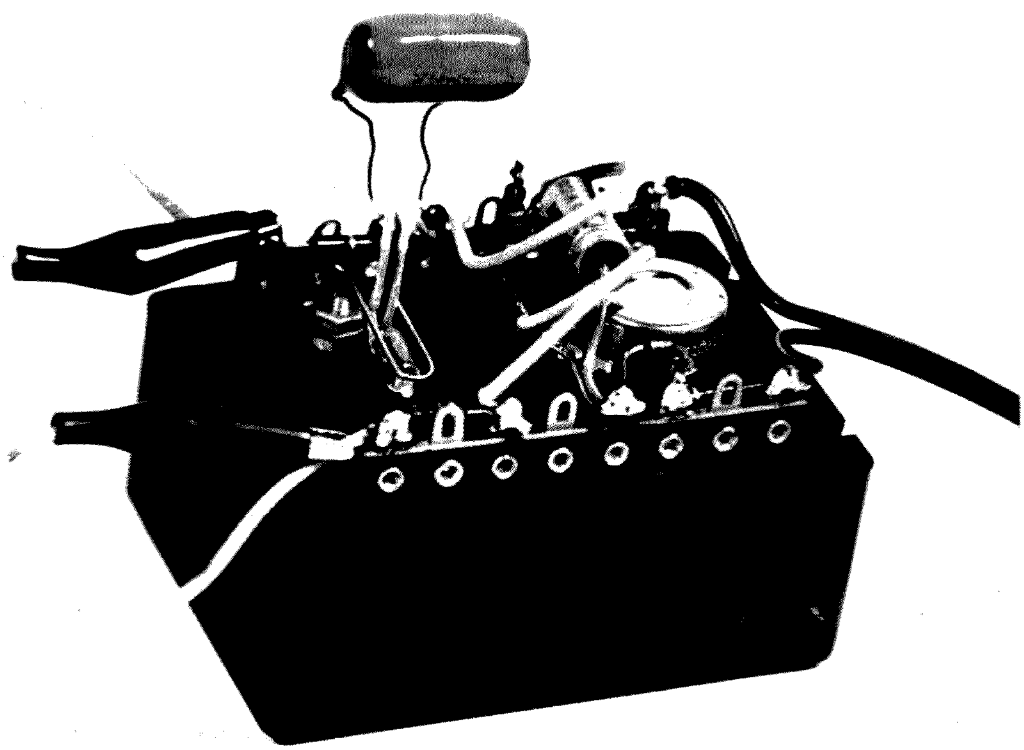


exhibit it, and until I caught wise, drove me up the wall. The cause was defective bypass capacitors which could fail in a variety of ways. They could go open or shorted, or just lose their capacitance. These were button-mica feed-through types. We were furnished an excellent GR electronic megger. It would measure megohms up in the hundreds or thousands, I don't remember. When a bypass had as little as one meg resistance to ground, it was time to get rid of it. The two hundred fifty volts, and the heat, would break it down in a couple of weeks and you'd get the amplifier back from the field. This was not good. The best solution was to replace every cap after the amplifier was in service for a couple of years, but there simply wasn't enough stock to permit this.

Good as it was, the GR megger was too much instrument for the job. What I needed was something simple, something cheap (I was buying) and safe, because Ma Bell was watching. It should be small – the GR took up too much bench and was heavy and clumsy.

The first design worked very well in practice. The basic standard was my wrist-watch, which gave me better than one part in 720 accuracy. Lighting juice went into the little plastic box to a DPDT switch. Thrown one way, it merely lighted a red pilot light (neon); the other way, connected it through a diode to a filter capacitor for a primitive power supply. A pot regulated the voltage. The slider went through a one meg limiting resistor to a binding post. The ground side of the pot went through a timing capacitor and another one meg resistor to the other binding post. Across the capacitor, an NE-2 bulb.

After the first few days, I forgot all about calibration, except for the most basic

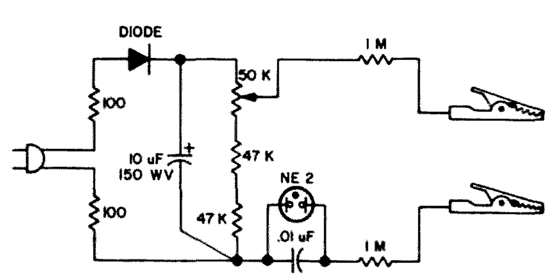


Fig. 1. Schematic.

adjustment. What I needed was a go, no-go instrument and I really had one in this gadget. All I really wanted to know was, would the cap work for a few months, or should I replace it? Twenty megs or two hundred was OK. Ten wasn't.

Of course, theory-wise, you are 'way ahead of me. It is a time-constant deal; when the voltage rises to 63% of the input voltage, you have one *time constant*, whether it is one Farad and one Ohm, or a megohm and a microfarad, right? There is something about that 63% – maybe here it suddenly becomes more horizontal than vertical, the charging curve – and anyway, an oscillator will come out to pretty close to the calculated time-constant value. And the NE-2 is both a relaxation oscillator and a timing indicator, right?

That's what *I* thought. There is a time constant that uses 63% right enough, but the time constant this gadget uses is very far from the classic one. Instead, it is time taken for the NE-2 to fall from the firing voltage of maybe 70 volts to the extinguishing voltage of about 69. You get approximately a one volt spread between these values. Of course, the timing capacitor size, the limiting resistor sizes, and the charging voltage are all factors. If you are looking for resistance, then you juggle voltage and timing capacitor size, until you come up with the proper value. Of course, it is most convenient to vary the voltage with a pot.

It surprised me that the ionize-non-ionize range was so small. I expected the voltage to drop to 15 or so. The CRO sweep tubes, 884/885/6Q5 will, but remember, they all have hot cathodes – this makes all the difference.

In actual use, I discovered that the safety switch was as useless as the well-known complementary accessories on the bull. Knowing that I couldn't possibly be hit, I was unable to remember the switch and found my fingers all over the external wiring. It was time for a new model. Perhaps a true go-no-go model *without* any adjustments? No, this was *too* radical. A pot and a knob and a hole to look through – that was the idea! And while I was about it, why not get rid of those silly binding posts? The

other change was to use standard commercial 8-lug strips rather than individual miniature standoffs, as in model one. Still another was to use shallow grooves in the plastic box ends for the ac input cord, and for the output clip-cords. I once knew a man who claimed that if you wanted to blow fuses, the best gadget for this was the standard alligator clip. He is right, beyond question, but in this case, with the load dead, it doesn't matter if the clip slips. And it saves a lot of bother with binding posts, which will eventually have clip leads on them anyway.

One thing I learned from commercial equipment: a ¼ Watt, 100 Ohm resistor makes an excellent fuse and protective device. Sometimes they shatter explosively, leaving only the leads. Sometimes they crack invisibly, and you find blown ones by twisting them with flats. Or, they may cook and spray the whole inside with bakelite varnish. No question what happened, the stink tells you. You can remove varnish and stink with mineral spirits (kerosene). They serve another purpose – they limit the peak charging current through the diode.

This is the model illustrated. The NE-2 (actually Japanese) was originally taped to the paper-clip, to a ground lug, which cannot be used for active connections. There are two of them. The panel has a half-inch hole for viewing the neon. The two straps short out padding resistors in the voltage-adjustment circuit, which were not needed.

Calibration is a cinch. Short the clips – with your fingers if you like – and adjust the pot for the firing rate you want. Say, 10 flashes in twenty seconds. Put your wrist-watch next to the gadget, and count flashes seen in your peripheral vision. A lot easier than it sounds, because every flash is equally bright, no matter how long you have to wait for it.

I have waited for minutes at a time to measure really high values, but for my purposes, this is time wasted. Who cares about hundreds of megohms? Now, with 10 flashes in 20 seconds you are timing out at one second per megohm, and actually accounting for the safety, or limiting resistors in the box. Naturally, you start your count with a flash, and then count 10

more, excluding the start, or zero flash. Now if you have one, stick in a ten meg resistor. What would your timing be now? Twelve seconds between flashes? That's ten on the outside, and two inside, huh? How about one flash after nineteen seconds?

Maybe you don't want to wait 19 seconds. Then calibrate ½ second per megohm. Or any other value you want. The instrument is surprisingly linear over a reasonable range, mostly because of its limited voltage excursions as it oscillates. In theory, when the external resistance being measured exceeds the leakage resistance of the calibrating capacitor, and it's got some, the said capacitor never will charge up. It will just sit there, discharging as fast as it charges. Don't worry about it – you are not likely to experience this effect.

All right, you built yourself a megger. What good is it? The first thing to do is pick a holiday – your birthday, 4th of July, whatever. On this day you measure the insulation of your refrigerator, your air-conditioner, furnace motors – and for the love of Mike don't forget your electric drill – they are killers because you are wrapped up around them in use. Don't forget the wife's kitchen either – stove, mixmaster, iron. Write down all the values you can read. Next year, do the same thing, or sooner if you like. Does any one of them show a marked drop in the winding-to-ground value? Dump it. Get a new one. It could save a life. The box probably *will* save you money, maybe fifty times its cost. If it does, you'll be a believer from then on out.

A VOM or a bridge is a multi-purpose instrument. I dislike other examples; however, too often an additional function just complicates an instrument, makes it expensive – or more so – and in general, doesn't work out well. For instance, you could set up the megger to measure small capacitors. Please don't. Leave the "high current" high voltage in that box where it belongs.

But I did have a very odd use for the megger. I was investigating hum sources in a Kellogg 401 vacuum tube. I tried various connections and discovered that the insulation in these was very good, whether the tube was lighted or cold. The bright ends

of the heater wires looked interesting, so I measured and got a nice reading – 50 megs – in the conducting direction. Assuming sixty volts, this gave me 1.4 microamperes as between heater ends and the plate support rods. This is a significant source of hum.

So far as I know, there are only two of these gadgets in the world. If they became popular, there might be two or three in a large city. Why wouldn't these little boxes be a perfect present for the man who has everything – else?

If he fixes TVs as a hobby and likes to measure leaks in coupling capacitors – yes. He'd appreciate one – any real technician would. But never think you could persuade a non-technical type to measure the electrical equipment around his house. To him, it would be pointless. To gift such a man with one of these is to provide a source of embarrassment to both of you. Sorry, but that's how it is. He will shelve it and hope you never mention it.

Of course, it's my baby, but I wouldn't be without it.

. . . BACH

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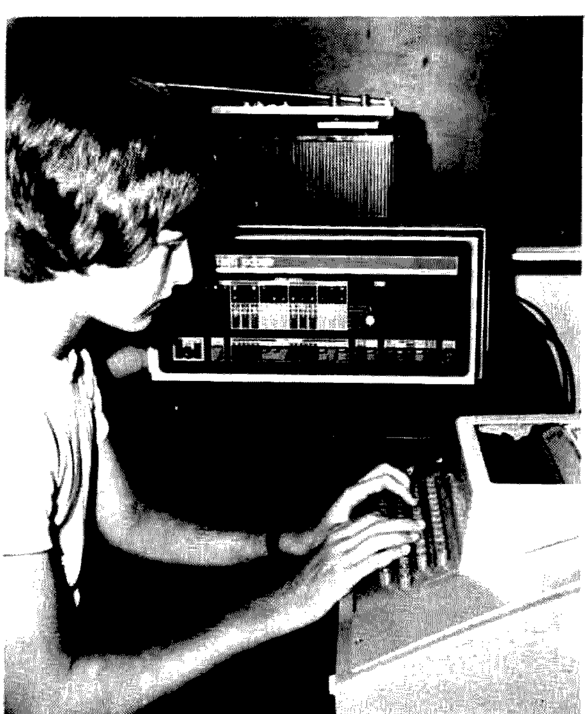
Say, OM, Are You a Computer?

As IC construction projects become more and more complicated, it becomes clear that the logical endpoint is a gadget that handles the whole QSO – sends out a CQ, answers the call, decides on a signal report, describes the rig, asks for (and promises) a QSL, and taps out a sincere "73" at the end. A recent *QST* project, the Contester, was in fact a fairly sophisticated unit for handling all of the bookkeeping in contest operation. In that article and others, the prediction of the computer-controlled ham station is made.



I've just seen a piece of that station in operation. Robert Snider, a 14 year old high school student in Cold Spring Harbor, New York, has configured a PDP-8 minicomputer to send and receive the International Morse Code. The interesting part of this is that it was not a construction project; Bob never heated up a soldering iron or bored a hole in a panel. Instead, as an exercise in *programming* for a math project, Bob essentially "taught" the code to the computer and devised an ingenious way for it to send and receive.

As computers go, the PDP-8 is a pea-brain. In reality, it owes its fame and success to the fact that it does less and does it more slowly than the computers that preceded it on the market. By being a not-too-bright midget, the PDP-8 started what some have termed "the minicomputer revolution".

Almost from the first machine that deserved to be called a computer – a room full of vacuum tubes at the University of Pennsylvania – the evolution of computers has been that today's machine is faster, does more, and has a larger memory than yesterday's. This progression of smarter and smarter machines – with higher and higher price tags – was in full flower when the designers of the PDP-8 realized that there were many jobs that could be handled by a computer of modest accomplishments. These jobs at that time were being done by laboriously designed collections of special circuitry because a simple (therefore cheap) computer just didn't exist. So the bright

guys at Digital Equipment Company took a fair-sized step backward and introduced the PDP-8 to what turned out to be a waiting world. The PDP-8 is slow, it has a limited memory, and as a mathematician it is pretty poor – it can only add. If you want subtraction you have to add a negative number. Multiplication and division are implemented by software subroutines. However, the PDP-8 was, for its time, small in size and dirt cheap. It became possible to think of the computer as a component, the controller of a larger system such as an automated drafting table, or the overseer of a complicated process like the management of a portion of a pipeline system.

Since 1958 when the PDP-8 was introduced, computers have been built into hundreds of systems, and the PDP-8's successors and imitators have proliferated until there are now scores of minicomputers on the market. The PDP-8 (shown with Bob Snider in the photograph), has been slimmed down considerably. Originally it was an ungainly 3 foot high unit with its PC boards showing. One manufacturer is even offering the "Naked Mini" – essentially a PDP-8 minus power supply, switches and cabinet – on a single giant PC board. Minicomputers can now be had, with performance equal to the PDP-8, for about $1500. Considering what the plutocrats in ham radio spend on their rigs, this is the right ballpark for inclusion in that "super station".

The job of programming a computer to handle the code was basically a simple one, according to Bob Snider. His ingenuity lies in the way he developed for the machine to send the code, without any electrical connections. For those of you who have never met a minicomputer, it's basically a RTTY op. You type to it; it types back to you. Since Bob's goal was audible code, this wasn't satisfactory. And since the computer is owned by Cold Spring Harbor High School, getting inside to make a wire connection to a keyer or code oscillator was forbidden. But Bob discovered that if he put the computer into a programming loop (in which it endlessly repeats the same operation), the machine generated enough stray rf to be heard on a nearby broadcast receiver. *Voila*, the wireless transducer!

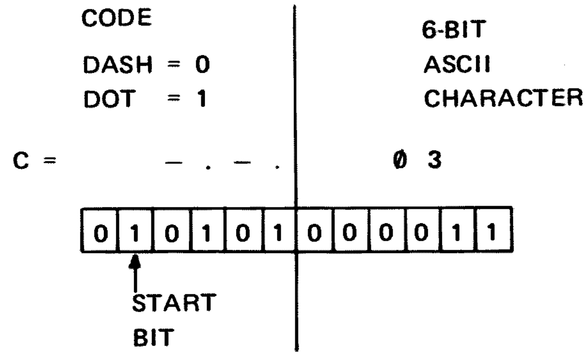


Fig. 1.

The program thus switches in and out of a loop for appropriate lengths of time to generate dots and dashes corresponding to the text that has been typed into it. Speed is no problem; it asks you what you'd like. It's equally comfortable with one or 99 wpm. In fact, it could go faster but for one thing which Bob considers a minor goof – he made the slot where you insert the desired speed only two digits long.

How is it done? Bob explains that the PDP-8 has a twelve bit word – that is, the basic building block of any program is a series of twelve binary digits. This also corresponds to one memory cell. The keyboard outputs 6-bit ASCII characters and the task of the program is to match these up with dots and dashes. Now, matching is something even a simple computer does well. So the six-bit ASCII character is inserted in the second half of the word, and the correct dots and dashes in the first half. How it works for the letter C is shown in Fig. 1.

The entire alphabet, plus the numbers, is stored in a table of these words in memory. When you hit a letter on the keyboard, the keyboard output (ASCII) is compared to the right half of the words in the table. When a match is obtained, the left half (code) is placed in a register and shifted left to the start bit, always a 1. This bit is ignored, but the next bit causes the loop to run to produce tone – for three units of time if 0 (dash) or one unit of time if 1 (dot). The units of time have been computed by another section of the program to be appropriate for the speed you asked for. Succeeding bits produce dots or dashes until the end of the six-bit half word (or "byte"). All characters are right justified, so the byte end serves as a stop signal.

This is the "SEND" mode of the program in which the computer sends to you. The "RECEIVE" mode has the human operator sending and the computer translating to typed characters on the teletype. No key could be connected by wires, remember, but Bob recollected that the "BREAK" key (used generally to interrupt a program in process) is the one key on the keyboard that gives a simple contact closure; no ASCII code is generated. So this key is used as a telegraph key.

The break key is not ideal for this purpose. I couldn't send the computer anything it liked. It kept typing out ERROR in response to my sending. It turns out to be rather finicky as to the rhythm and spacing it will accept. It reads Bob Snider like a champ, though.

I should add at this point that the program wasn't designed to duplicate a code typer or code reader. Instead, it was conceived as a teaching machine to teach the code to complete neophytes. For this reason, it has other modes than "SEND" and "RECEIVE". In the "LOAD" mode, the user types a complete message into memory, which on the SEND command the machine transmits to the radio. Proper character and word spacing for the selected speed are automatic.

In the "LOOK-UP" mode, the user types any letter or figure, followed by an equal sign, and the computer prints the code character using periods and hyphens for dots and dashes. There's even a "TUNE" mode, in which the computer "holds its key down" so that you can adjust the radio's tuning and volume for best reception.

This program won the top award for Bob Snider in the Long Island Mathematics Fair. He submitted a paper describing the program, and then, on March 22, 1974, gave the paper orally and demonstrated the technique for a panel of judges. In competition with the work of the brightest math students from schools all over Long Island, Bob's project won. In talking to him and seeing the demonstration, I got the distinct feeling that he considers this program kind of old hat by now. It turns out Bob Snider developed this when he was in the 8th grade. His advisor also told me that Bob has won the Long Island Mathematics Fair three years in a row, a feat about as common as a team winning the World Series three years in a row.

Bob's into other things now – reprogramming the computer so it can be time-shared among several users, and possibly handle the Cold Spring Harbor High's attendance and scheduling records as a side job.

He admitted he's too busy with these things (and a new sailboat) to think about getting a ham ticket. So if you do contact a computer one of these days, it probably won't be Bob Snider behind the scenes.

It also may not be in the CW portion of the band. While I was at the school, another teen-aged programmer, Craig Hansen, demonstrated his latest program for me. It seems Craig's program makes the PDP-8 literally *talk* – in a pleasant baritone voice that's completely synthesized from binary numbers. Not perfectly though. It speaks a little too slowly for contest work . . .

. . . W2IAT

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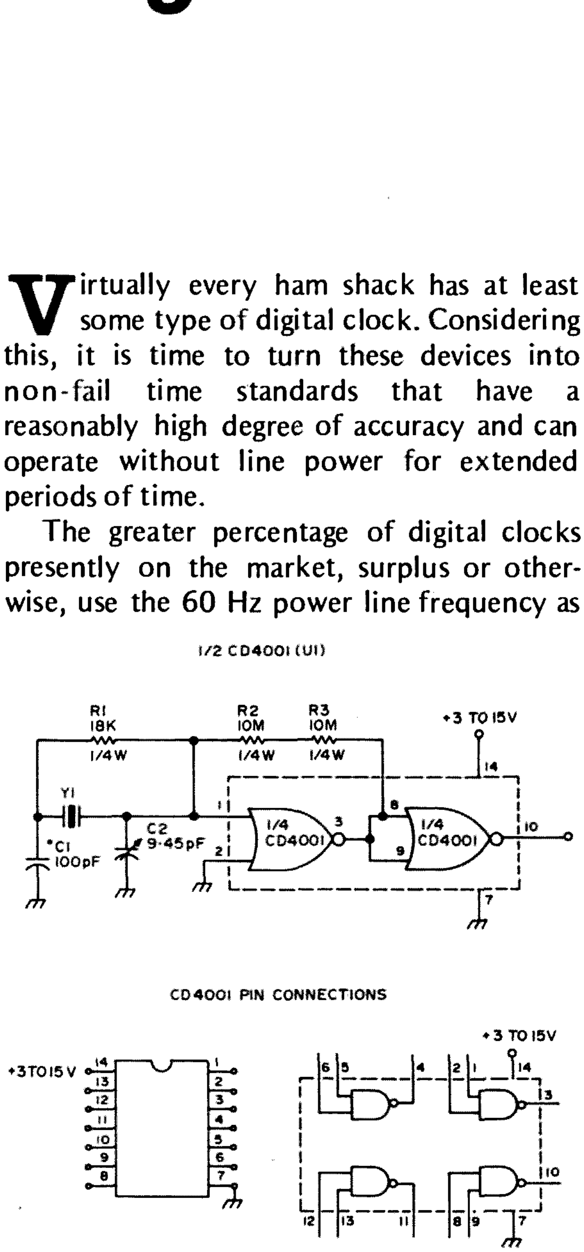
Digital Clock Time Bases

Virtually every ham shack has at least some type of digital clock. Considering this, it is time to turn these devices into non-fail time standards that have a reasonably high degree of accuracy and can operate without line power for extended periods of time.

The greater percentage of digital clocks presently on the market, surplus or otherwise, use the 60 Hz power line frequency as their time reference. Also, the majority of these clocks employ large scale integrated circuits. The line frequency source is reasonably accurate; however, if you desire increased accuracy and reliability, crystal control is the answer, especially during power failures.

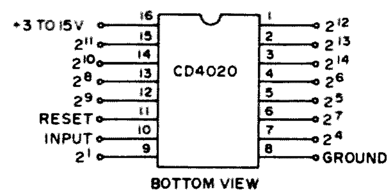


C1 = 100 pF silver mica capacitor. This value may have to be determined experimentally depending on the crystal frequency you are using. 100 pF is a good value to start with.

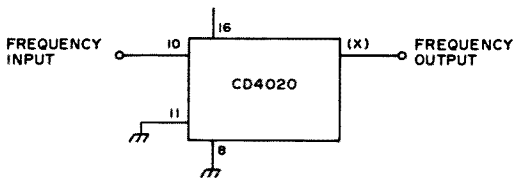
Fig. 1. Basic CD 4001 oscillator.

The greatest power consumption in a digital clock is that consumed by the LED readouts. The clock "chip" does not usually require a great deal of current. Therefore, if you are operating on crystal control, only the crystal, divider chain and clock chip must be provided with battery power during a line power failure. As we have mentioned before, the clock integrated circuit requires only a few milliamperes. The LED readouts can be wired so as to automatically extinguish during a power failure.

The next problem of concern is that of the crystal oscillator and divider chain. For a reasonable degree of timekeeping accuracy, a moderately high frequency crystal must be employed as the standard. When the crystal frequency is divided down to 50 or 60 Hz, the ratio must be great enough so that minor crystal drift will not appreciably affect the 50 or 60 Hz output. We mention 50 or 60 Hz because this is the necessary "clock" frequency needed for proper operation of common clock chips. With minor circuit modification, the majority of chips will function equally well with 50 or 60 Hz.



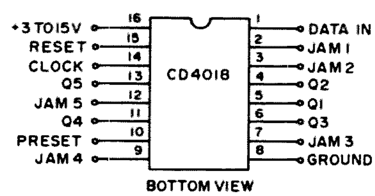
TYPICAL HOOKUP



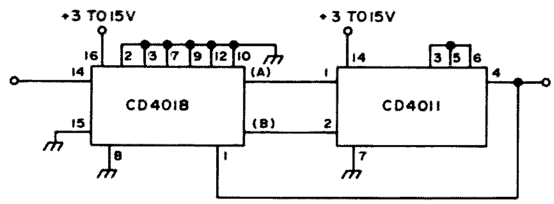
Note: Pin (X) should be the following for desired divisions.

Division Desired	Pin (X) number
2^{14} (16,384)	3
2^{13} (8192)	2
2^{12} (4096)	1
2^{11} (2048)	15
2^{10} (1024)	14
2^9 (512)	12
2^8 (256)	13
2^7 (128)	6
2^6 (64)	4
2^5 (32)	5
2^4 (16)	7
2	9

Fig. 2. CD 4020 pin connections and divide by 2 configurations.



TYPICAL HOOKUP



Note: CD 4018 pins (A) and (B) should be the following for odd divisions.

Division Desired	Pin
"9"	A=11, B=13
"7"	A=6, B=11
"5"	A=4, B=6
"3"	A=4, B=5

Fig. 3. CD 4018 pin connections and odd division configurations.

When you think of a crystal divider chain, it is common to imagine a large number of ICs consuming a considerable amount of current. With garden variety TTL integrated circuits the above was true. COS/MOS ICs present a completely different story. This new breed of low power integrated circuit can make a very low power divider chain entirely possible. The crystal oscillator, divider chain and clock chip all working together will represent only a small current drain. The COS/MOS devices also will work well over a much wider voltage range (3 to 15 V) in comparison to TTL (4.75 to 5.5 V). The COS/MOS devices used in divider chains are also quite inexpensive.

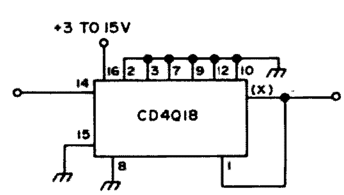
The run of the mill cheap kate such as myself doesn't mind spending a small fortune on ICs; however, spending $2.50 for a proper crystal is another story. Get out that batch of surplus crystals that you have been hoarding, as it may well surprise you what can be divided down to 50 or 60 Hz.

Using COS/MOS integrated circuits, an average divider chain including oscillator can be constructed for about $10.00 – probably less.

The upper frequency limit for COS/MOS ICs is approximately 3 MHz and it is not wise to exceed these limits for reliable operation. Crystals below 30 kHz are not really common and the ratio is not great enough for exceptional accuracy.

In all cases, the oscillator is the CD 4001AE quad 2 input gate. This circuit (Fig. 1) is quite good and most stubborn crystals

CD4018 TYPICAL HOOKUP



Note: Pin (X) should be the following for desired divisions.

Division Desired	Pin
"10"	13
"8"	11
"6"	6
"4"	4
"2"	5

Fig. 4. CD 4018 – even division configurations.

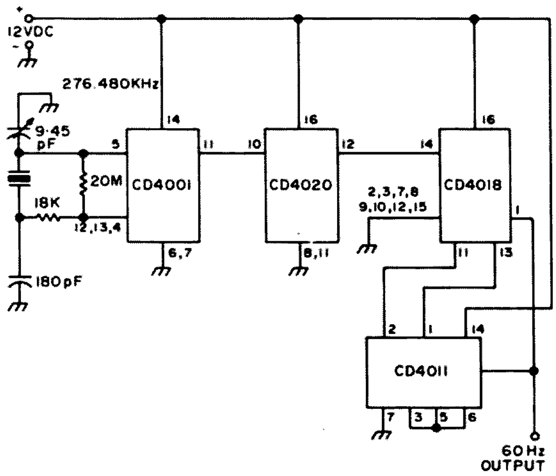


Fig. 5. 276.480 kHz to 60 Hz divider chain.

will work well. C2, the 9-45 pF trimmer capacitor, should be either ceramic or a good grade air dielectric variable capacitor. This is used in conjunction with Cl to adjust the crystal exactly on frequency. C1 should be a good quality silver mica capacitor. Depending on the crystal frequency, the value of this capacitor (C1) may have to be altered. 100 pF is a good value at which to start for crystals in the 100-300 kHz range. A frequency counter is perhaps the best way to align the crystal frequency. With odd crystals, it may be difficult finding a harmonic that will zero beat with WWV.

Before we proceed further, the COS/MOS devices have built-in protection against electrostatic effects; however, certain precautions must be taken. Handle the IC as little as possible and leave it in the protective "black plastic" until you are ready to insert it in its socket. Ground yourself, the PC board and your soldering iron and do not touch the IC pins when inserting it in the socket. It is wise to use sockets but if you must, solder the ICs in place using as little heat as possible.

The CD 4020AE is a 14 stage ripple carry binary counter/divider and the CD 4018AE

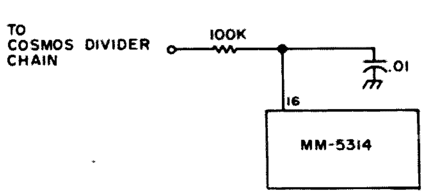


Fig. 6. Divider chain to National MM-5314. Note: Should the 5314 not count, decrease the value of the 100k resistor.

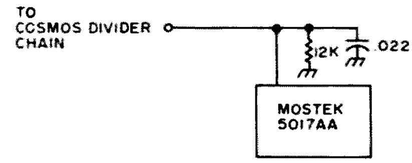


Fig. 7. Divider chain to Mostek 5017AA (Heathkit clocks).

is a presettable divide by "N" counter. By using proper combinations of these two ICs a wide variety of crystals may be divided down to 50 or 60 Hz.

The CD 4020AE has the ability to divide by two fourteen times, which results in a total division capability of 16,384. Other pins on the IC sample division flip flops at 2^1, 2^4, 2^5, 2^6, 2^7, 2^8, 2^9, 2^{10}, 2^{11}, 2^{12}, 2^{13} and finally 2^{14}. The assorted division capabilities of the CD 4020AE are then 2, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192 and 16,384 respectively. Output pins for 2^2(4) and 2^3(8) are not provided on the IC. Fig. 2 illustrates pin connections for the CD 4020AE. Fig. 2 also illustrates how you would wire this IC for divide by configurations of 2.

The frequency input would go to the CD 4001 oscillator pin #10. An illustration such as this makes it easier when you are seeking a particular needed division.

The CD 4018AE presettable divide by "N" counter was primarily intended for synthesizers and other exotic devices. It has the ability to divide by 10, 8, 6, 4 and 2 with no external components. If you desire to divide by 3, 5, 7 or 9, a CD 4011 positive NAND gate must be employed, in addition to the CD 4018. Fig. 3 illustrates pin connections for the CD 4018AE. Fig. 3 also illustrates pin connections for the CD 4018AE. Fig. 3 also illustrates how to wire the CD 4018 and CD 4011 for a divide by 9, 7, 5 and 3 respectively. Fig. 4 illustrates wiring of the CD 4018 for division of 10, 8, 6, 4 and 2.

With a good variety of surplus or oddball

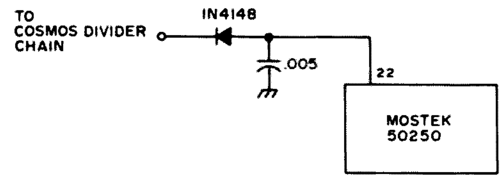


Fig. 8. Divider chain to Mostek 50250 clock chip Radio Shack #276-1751.

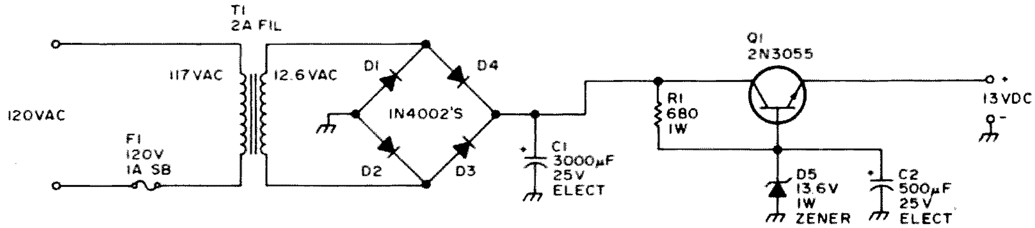


Fig. 9. Power supply.

crystals, there is a good chance you can find one that will divide down to 50 or 60 Hz. The easiest way that we have found to do this is with a calculator. Take the crystal frequency and divide it by 10s, 9s, 8s, etc., until you arrive at a small enough number that you recognize as a multiple of 50 or 60. If this does not work, try dividing by 7, 8, 7, 8, etc., or other combinations. Of course, you can try dividing the crystal frequency directly by 50 or 60. All of this may sound tedious but it does work.

As an example, a crystal frequency of 276,480 Hz would require division by 2 (9 times) and then by 9, giving a total division of 4608 to obtain 60 Hz out. Fig. 5 illustrates the CD 4011 oscillator stage, a CD 4020 wired to divide 2 (9 times), and a CD 4018 and CD 4011 wired to divide by 9 resulting in an output of 60 Hz.

By using the basic building block IC diagrams, you should have no problem creating your own crystal divider stage for a digital clock.

Figs. 6, 7 and 8 show how the divider chain 50 or 60 Hz would be fed into three common clock integrated circuits. Fig. 6 is the National MM-5314 which has been used in many recent published clock projects. Fig. 7 is the Mostek 5017AA which is the chip used in the Heathkit digital alarm clocks. Fig. 8 is the Radio Shack #276-1751 (Mostek 50250) clock chip.

Fig. 9 is a power supply that can be employed for the "perpetual" clock system. With our particular system, we were using the 50250 clock chip which operates nicely from 9 to 15 volts. The 13 volt supply for the ICs ran both the 60 Hz divider chain and the 50250 chip. The reason for using 13 volts is to facilitate changing over to a 12.6 volt battery during a power failure. Fig. 10 is the "changeover switch" from power line to battery. When +13 volts is present from the ac supply D1 conducts and D2 is reverse biased so the battery source draws no current. When the 13 volt source drops below 12.6 volts, D2 conducts and the battery automatically takes over. With this system there is no interruption in timekeeping whatsoever.

I hope that the previous will give you many ideas which you can apply to your present digital clock to make it "perpetual".

. . . W2AOO

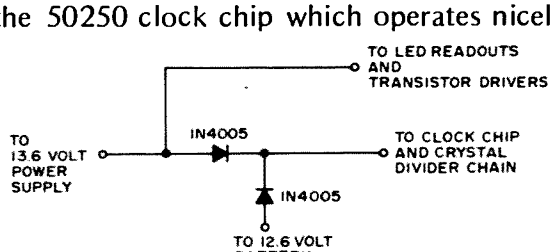


Fig. 10. Power changeover diodes.

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Fast Dive on Five

or, Assault by Battery

Something was definitely cockeyed with the little airplane. It was a Waco biplane, powered by a World War I OX5 Engine. Looking out from my open cockpit, houses and streets were directly off the wing tip, sort of topsy-turvy as we flew in a tight circle, tipped way over and going down. Centrifugal force pressed me into my seat. It was almost like being in a huge whirlpool, with very hard ground coming up at us fast, now only a thousand feet or so away.

Whipping around, I saw the pilot's contorted face. Charlie Saxe was not one to panic easily. But he was yelling at the top of his lungs and pointing a finger at me. I couldn't hear what he was saying due to the rush of air and roar of engine and propeller. Then he pointed his finger down in a jabbing motion toward the plane's flooring.

I looked down. In the blinding sunlight and because the radio gear in front of me obscured my feet, I could detect nothing wrong. However, something was dreadfully amiss with his controls. It looked as though we'd had it.

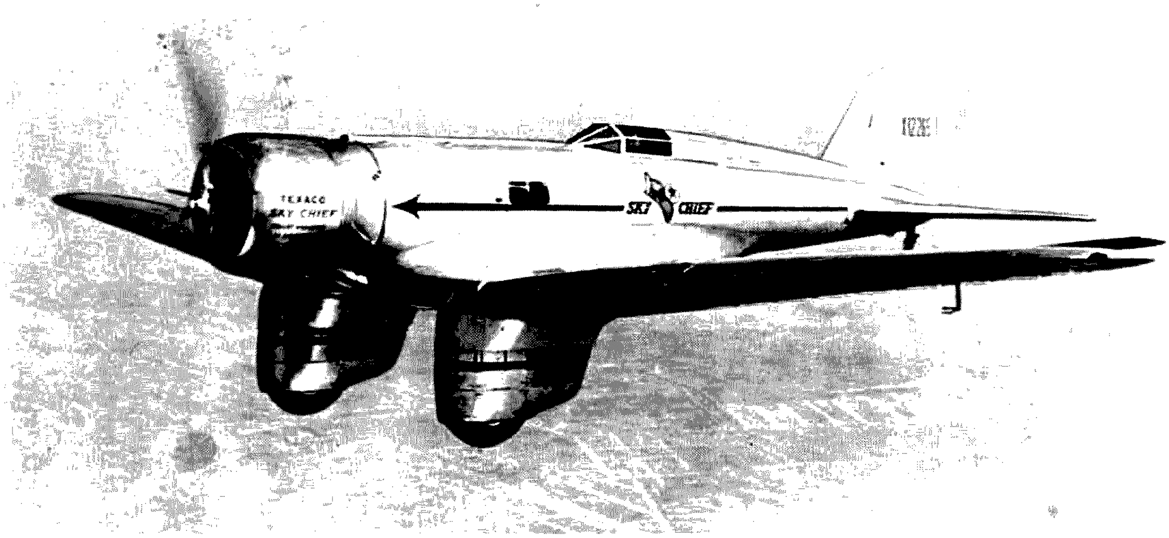
How did we get in such a crazy situation? I'm sure Charlie Saxe was asking himself that and wondering why in hell he had succumbed to my blandishments about ham radio and the marvelous new 5 meter band. And aircraft mobile operation!

For a moment, let's go back a bit. Very high frequency radio experiments all started for me in the early 1930s. The interest was stirred up by my good friend Ross Hull, brilliant radio engineer, inventor and master of many arts. As one of the top men at ARRL headquarters in West Hartford, he had developed and published in QST a number of fascinating AM voice circuit configurations for small 5 meter (56-60 MHz) gear, particularly suitable for mobile operation.* Although the units were reasonably compact, the main drawback was their dependency on vacuum tubes with high filament current characteristics. This required a heavy-duty storage battery. Plate power came from banks of 22 volt "B" batteries, the transmitter input being only a couple of Watts.

"Just think," Ross said, "for millions upon millions of years there's been nothing but utter silence in this section of the spectrum. Not even static. Get out there and make some noise – and some records."

It was pretty much line-of-sight stuff, comparable in a way to our current 2 meter activity. Satellites and repeater gimmicks? Hell, no. Prearranged schedules were

*Note: Amateur operation in the 5 meter band was later withdrawn by the FCC.



Distance-Altitude Charger: In this fastest plane of transport type in the world, Lieut. Commander Frank M. Hawks traveled the air lanes high above the earth seeking to learn new secrets for aviation. The craft, christened the Texaco Sky-Chief, attained its greatest efficiency in the high altitudes, cruising at more than 200 miles an hour for 2,500 miles, at any height up to 30,000 feet. With this plane Hawks was demonstrating in terms of speed and load the transport possibilities first agitated with the midget mystery ship which he formerly flew. Among the many newest improvements of aeronautical science with which the plane was equipped was an automatic robot pilot to keep the craft indefinitely on any set course without the help of the man flying it. A split trailing edge of the wing provided a pair of flaps or "air brakes" which when lowered permitted landings at less than 50 miles an hour or in an unprecedented ratio of 5 to 1 between top and landing speeds. Modified use of the flaps also gave the plane greater lift, reducing the takeoff run approximately 30 percent. The ship was an all-metal full cantilever Northrop Gamma powered with a Wright Whirlwind engine of 14 cylinders, the first such power plant produced commercially, others having gone to the U. S. Navy.

practically a must. Otherwise, one could be getting out like a ton of bricks – with nobody around to hear the signal.

Following Ross Hull's suggestion, I had built up two transmitters and two receivers. The best antenna proved to be a half-wave vertical steel curtain rod, brass plated and fed with an open wire line. Soon, another local ham, Ralph Hunter W2AKH and I had used the units for many mobile operations from a base station in my family's house at Catskill, N.Y., to a car or speedboat in motion up to 10 miles or so away on the Hudson River. In August, 1932, a world record of about 75 miles was made between my station, W2AMD mobile at the Catskill Mountain House at 2,200 feet, to W1WR on Mt. Greylock, Mass., a line-of-sight path.

Shortly after came our fast talk with Charlie Saxe, suggesting he let us try operating from his plane. We figured this would really rope in some DX. His welcome cooperation soon led to my taping the half-wave vertical rod to one of the wing struts on his little aircraft. A horizontal structural bar at about chin level across the front of the passenger cockpit offered an ideal place to strap the small transmitter and receiver boxes. To let Charlie in on the fun, I'd paralleled a pair of headphones, so at least he could hear our ground stations. But he had no microphone.

Well, to get back, we were soon airborne and in dandy contact, not only with my ground station but with Ross Hull in West Hartford, some 70 miles away.

Then I asked Ralph at W2AMD to suggest to Charlie that we fly back over Catskill and circle over the town, testing signal strength at close haul. And that's when the trouble started. The radio contact is what saved our lives. Fortunately the mike cord was long enough to hand the mike back to Charlie, who instantly got the idea, as I switched to

transmit. I could see that he was talking into the thing but of course couldn't hear what he was saying. When he'd obviously finished, I switched to receive and immediately heard Ralph's voice, "Charlie says for Chrisakes get your goddamned feet off the controls before the goddamned plane crashes!"

I knew that my feet were nowhere near the dual controls. Hastily removing my safety belt and twisting down, I discovered the trouble. The filament storage battery, not tied down as it should have been, had slid across the floor boards and jammed the dual foot control into our steep downward turn. With enormous effort by hands and feet, I managed to move the battery against centrifugal force – and uphill. Aided by Charlie's foot pressure on the controls, I got it far enough out of the way so that we resumed level flight.

Catskillians later swore that our landing wheels swept so low over the town that leaves fluttered down from some of the higher elm trees.

You'd think that my joy ride on that afternoon would have chilled any further experiments in aircraft. Not so. The following year I was zooming along at 10,000 feet over eastern Connecticut in Lieut. Commander Frank M. Hawks' Sky Chief low wing monoplane. He had me comfortably stowed in the luggage compartment between the gas tank and his pilot's seat. His feet and a maze of wires and cables were close to my back. Again we were running experiments with Ross Hull, who was operating from his house on Selden Hill in West Hartford. Our gear was approximately the same as my earlier stuff, but this time our attention was on improved antennas. A big half-wave rod was not practical on Frank's all metal, streamlined plane. We had settled on a quarter-wave job, which was bolted to a plastic plate just over my compartment. This worked just fine. We made additional contacts with stations in Boston, Providence and New York.

However, earlier in the day things had not gone so well. Some clown at Frank's Springfield airport had secured the ¼-wave vertical in a weird lash-up that had a streamlined plastic housing around it. But, oh boy, you

Lt. Comdrs. Frank M. Hawks and John M. Murray at Springfield, Mass., where Hawks' new GeeBee racer was being built in 1933. This plane and a somewhat similar one for Jimmy Doolittle, later of Tokyo raid fame, was almost entirely constructed of laminated wood – and seemed little more than a platform with stubby wings for an enormous engine.

just can't go hanging things on airplanes willy-nilly. On our first takeoff from Hartford's Brainard Field we had reached altitude and were headed for coastal regions near Providence, R.I. Suddenly, all fury seemed to break loose in a tremendous vibrating noise directly over my head. Through the wires and cables, I looked up at Frank. He didn't seem to be concerned, maintaining the marvelous calm which characterized the guy. He waved a sort of "don't worry about it" hand at me. Nevertheless, we immediately went into a sharp descending curve and headed back toward Hartford. For an instant the noise stopped – then increased greatly and the whole airplane began to shake and vibrate. Next came an explosion like a shotgun blast. The vibration ceased and so did Ross's radio signal. Frank smiled and scribbled a note on the pad strapped to his knee. This he held out to me, "Resonant point – wind vibration of antenna housing. Broke loose. All OK. Cheer up!"

Back at Brainard Field we soon had another ¼-wave vertical job secured, minus the screwy streamlined housing. Two small guy wires with egg insulators were fastened fore and aft to the airframe skin.

Since Frank Hawks had become somewhat of a national hero in the wake of ocean fliers like Lindbergh and Amelia Earhart, quite a crowd of well wishers, if not hero worshipers, had begun to hang around the airport while we were on the ground. Naturally, a few police began to show up to keep things under control. One officer of immense frame, with walrus mustachios, seemed to always be on hand, looking for trouble and with a jaundiced eye toward our whole operation. Judging by his braid, he was real big stuff around town. "You fellers are going to smash yourselves yet in that flying machine," he told us. "If the Good Lord had wanted man to fly, he'd have screwed wings on his back."

Frank surveyed the old boy politely. "I'll give you a nice ride later, Chief."

"No, thank you, son."

Once more we were off with the repaired antenna working beautifully. I stared at the huge green painted gasoline tank that formed the front wall of my compartment. Scrawled on it in pencil was a cute little message from another famous Atlantic flier: TANKS FOR THE RIDE, FRANK. AMY MOLLISON.

Ross Hull's familiar accented Australian English came booming over our headphones, "Frank, old chap, would you please take her up to about 12,000 and circle Hartford within about 10 miles? I've got the new rotary directional antenna ready for a try."

"Will do," said Frank. We began to climb sharply.

To the west the sun was lowering toward the Litchfield hills. Below, a snake-like ribbon of silver indicated the Connecticut River as it wound off into the haze toward Long Island Sound. Up, up we went.

Again Ross's voice. "Oh, yes. You characters are expected out here for cocktails when you return to earth. KB (Warner) says he'll meet you at the airport. How's your altitude?"

On this flight we had a monitor, so I could hear both sides of the conversation.

"Just about 12,000," said Frank. "We're now over the center of Avon, heading east."

"OK," said Ross. "Please peak up your signal for maximum output. I'm going to take readings as I change the vertical angle as well as rotate the antenna."

At some 250 miles an hour plus we weren't going to be over the tiny town of Avon very long.

Frank turned half around in his seat to make the adjustments Ross had requested. The transmitter and receiver were on a shelf behind his head. In turning, his knee pushed lightly and then with more pressure against "the stick". Of course, the plane nosed down, our speed certainly increased and my blood pressure began to mount. By now we were practically in a power dive right over the center of Hartford. And Frank continued fussing with the radio, an activity in which I had lost all interest.

A quick glance out the window showed we were headed almost exactly for the Travelers Insurance Company's huge tower – and streets which probably were crowded with evening commuter traffic.

Was I, who had never piloted a plane, to

tell the great Frank Hawks how to handle his ship? Would he never quit those adjustments to the radio? Along about then the self-survival urge took over! Acting almost mechanically, I reached back and grabbed his ankle. That ought to get his attention. It did. He turned a pleasant smile on me and pulled the stick back easily, bringing us back to level flight. I could feel warmth returning to my cheeks. In fact, my face was very red.

It was certain that our power dive had raised a fearsome noise over the city. There was no delay in our being reminded of this when we landed and taxied up to the control tower area. Our mustachioed police chief friend came purposefully striding toward the plane, looking like a thunderstorm. "Commander Hawks, I regret to inform you that there is a city ordinance against the kind of games you have been playing up there. You may consider yourself under . . ."

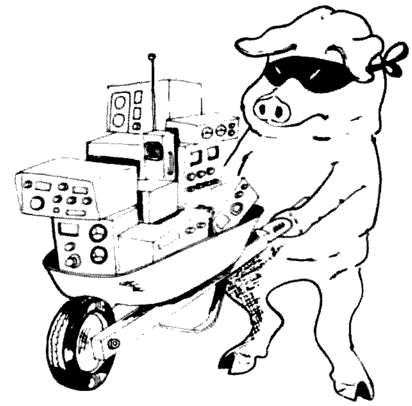
His words were cut short by the screaming siren of a big black limousine which drove up near our plane. Out popped a little man, the mayor of Hartford, all smiles. He was arriving for an official welcome. "So sorry I was unable to get down here sooner, Commander." The law, stroking his whiskers, quietly faded into the background and was not heard from further.

Later, at cocktails with Ross and KB, Frank turned on his weatherbeaten smile. "If I live to be 100, I'll never forget the look on your face when you grabbed my ankle. I was aware of our dive, but there wasn't any real danger – and I like a little speed, as you know. If I'd been in your shoes, though, I think I'd have done the same thing."

Despite those reassurances, I've always wondered just how aware he was of that dive. Only a few years later, while demonstrating an "absolutely foolproof" plane over an upstate New York golf course, he flew himself into some high tension wires. And that was the end. The very end. As Jimmy Doolittle once remarked, "There are plenty of stupid young pilots around. But I don't know of any stupid old pilots." Perhaps, in this case, more tolerant judgment would suggest that Frank was merely a trifle careless.

. . . W1BNN

The Hamburglar STRIKES AGAIN!



HIJACKED: IC22 s/n 13-12-122 2m FM in Dallas, Texas on August 11, 1975. Report to Perry W. Barker WA5IKU-OVS, 2240 Prichard Ln., Dallas, Texas 75227.

ROBBED: Standard 826M s/n 203046. Notify Jack C. Hemby, 3408 O'Hara Rd., SW., Huntsville, Ala. 35801, or the Huntsville, Ala. Police Department.

ABDUCTED: Motorola PT-300 s/n J-28196, Nicad pack and charger crystals 146.34-94 and 146.31-91. Contact WA2AJQ or Syracuse, New York Police Department.

LIFTED: FMDX s/n 090 in Passaic, New Jersey on August 6, 1975. Contact Mike Stefanik K2QHI, 504 Grace St., Garfield NJ 07026.

HAM HELP

According to long-standing policy, *73 Magazine* makes a continual effort to match those in need of technical help or instruction with those who feel they can offer it. If you find yourself in one of these two categories, please do yourself and amateur radio a favor by contacting Ham Help, *73*, Peterborough NH 03458.

Alan Binkelman WN9RNS
N28W27535 Peninsula Dr.
Pewaukee WI 53072
691-4232

Louis Bobrowsky
83 Shore View Drive
Yonkers NY 10710

Henry Schmelzer
725D North Miami Ave.
Sidney OH 45365

I'd be glad to help Novices.

Dr. P. J. Lester WA9UCM
204 No. Park St.
Streator IL 61364

I want to help stem the tide away from ham radio. I have taught local Advanced class, and want to be of help to others.

George P. Shanks WB5MAY
3165 Whitemarsh Cr.
Dallas TX 75234

I need help to pass that tricky Amateur General Class examination. I am a CBer and I wish to get off 27 MHz and into legitimate radio.

Charles L. Servais
4774 Falmouth
Shawnee Mission KS 66205

from page 3

regular computers. The Altair system can do just about anything one of the $100,000 computer systems can do!

There are quite a few games available in Basic and, after a few demonstrations of simple calculations done with the Basic program, they fed in a Hammurabi game – a relatively simple game whereby you have to figure out how much wheat to plant, how much land to sell or buy, etc., to run a small mythical kingdom. Unless you are pretty sharp you end up wiping out the country in short order as I did. Probably the worst result of this is an almost instant addiction to computer game playing.

People's Computer Company, Box 310, Menlo Park CA 94025, has a whole big book of games you can play on your computer – book is $7 and a bargain. The game programs are in Basic.

Having heard horror stories about some computer nuts getting so addicted to the Star Trek game that they have allegedly almost starved to death rather than leave an unfinished game, I found that MITS did indeed have a program for said game. It is formidable, requiring 24k of memory, and that isn't cheap even yet. Oh well, it's only a hobby, right?

There are some exciting developments on the way in bulk memory storage devices – Sphere is talking about having 1,500 Megabytes available at a very reasonable (hobby) price! Almost every day I hear about another firm entering the field producing memory boards, interface boards, computer boards, video display boards, etc. It's exciting, and there will be a lot of fallout for the radio amateur.

Most of this stuff is directly usable for RTTY and much will complement slow scan. A whole new era is upon us. I'm reading everything I can get my hands on so I'll know what's happening and be in on it – how about you?

TUCKER AND JUGE

While on my swing through the Southwest I paid a short visit to my old stamping grounds in Dallas/Ft. Worth. Things have sure changed since I lived there a few years back. I used to live way out in the outskirts of Dallas – this time the outskirts had moved several miles past my old digs and it was solid houses instead of fields.

No visit to Dallas would be complete without a stop at Tucker Electronics. Jim has a fantastic thing going out there – and a two meter FM signal that lifted just about every repeater for three states around. I managed to get there while Jim was away on vacation, unfortunately. Well, better luck next time.

Ed Juge was hard at work when I visited him and we rapped for several hours. He's got a very good thing going in Ft. Worth – and you'll have a hard time finding a nicer chap to talk with.

I was hoping to find more fellows to talk with on the repeaters, but despite repeated attempts at raising a contact, I managed very few. There are a fantastic number of repeaters there, but I seldom heard more than the 34/94 in use. No, it wasn't that my call turned them off, I don't think anyone ever gets my call right the first time around, and darned few the second or third. I'm used to it now. Oh, I spell it out, but the call is forgotten before I'm through giving it. No, it wasn't anything personal against W2NSD/5, just a current FM way of life that I was bucking.

Dan Meyer, the chap who brings us the SouthWest Technical Products video display and keyboard kits. Dan had a big surprise for me . . .

BOX SCORE

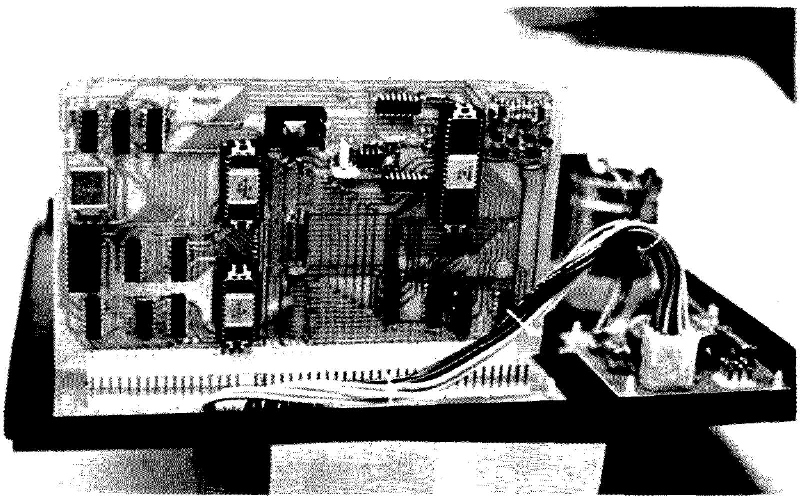
The ads in a ham magazine are of particular interest to readers – we all want to know what is new, where we can save some money and (probably most important of all) where we can get what we want. Ads are the major means for selling ham products, so they are of interest to manufacturers, too. And since ads help pay for more pages of articles in a magazine, this is another benefit to the readers.

The circle works out like this – the more ads, the more articles; the more articles and ads, the more readers; the more readers, the more ads (because there are more products sold). It feeds upon itself and everyone benefits.

During the last quarter 73 has run 252 pages of ads, QST 180, HR 126 and CQ 76, near as I can count. Thus, despite the strictest advertising policy in the field, 73 has run substantially more ads.

About that strict ad policy – if you ever have any legitimate gripe with a manufacturer or dealer, please make sure to send a copy of your letter to me so I will know what is going on. This particularly holds for dealers who are having troubles with manufacturers or importers. Every now and then something comes up and only after I have put something in print do I begin to get the full horror story of what has been happening. Please clue me in when something is fishy.

For instance, there was one manufacturer who was shipping sets to dealers and they were bouncing back like rubber balls. Would you believe eleven sets to one dealer and not one single one worked right? This advertiser is no longer in 73 . . . but you'll find his ads in at least two of the other magazines . . . good luck. Another pulled so many funny deals it would take a book to reprint the complaints . . . he, too, is advertising in a couple of the other ham magazines . . . good luck. How about an outfit that will under no circumstances make a refund? . . . good luck again . . . with ads in two other ham mags.



The SWTPC surprise – a working computer unit using the Motorola M6800 chip. This was hooked up with the keyboard and video display for input/output.

And how about the manufacturer who has been shipping sets COD, knowing they are defective? The sets come back for repairs and are promptly resold to other COD buyers ... good luck. The ads for this bomb are not in 73. You like antennas? You may be lucky enough to spend a bundle and get something that works almost as well as a piece of window screen ... but not out of 73 ... and good luck to you. Or perhaps you'd like to buy some antenna kits which turn out to be inferior grade aluminum tubing and a set of mimeo instructions telling you where to drill holes and how long to cut the elements? ... they're cheap, but you won't find 'em in 73 ... I'd tell you where to look, but you'd accuse me of being rotten to someone. Good luck.

Disclaimer ... there are a few manufacturers who won't advertise in 73 ... they don't like the editorials and feel that they can force the editorial policy to change by refusing to advertise ... that won't work: Only letters from readers will do this, since 73 is in the business of providing a magazine to be enjoyed by readers, not to express manufacturers' beliefs ... unless they want to buy the ad space, and then they are welcome to say anything they like as long as it doesn't open us to another damned law suit. At any rate, just because someone is not advertising in 73 it doesn't mean that we won't take their ads ... I wish it was that way ... but not enough to turn the editorial column into a lily-livered committee effort. The fact is that I will continue to say what I want to, whether I *agree* with myself or not. I really don't care if many readers agree with me either ... I only ask that they think.

FOX HUNTING

There has been a substantial increase in interest in transmitter hunts of late. This may be one of the results of increased radio club activities, it may have to do with the sun spot null and a generally enervating situation on the DX bands, or it may be one of those cycles which has yet to be identified as to origin.

Let this be public notice that 73 magazine is interested in getting articles on fox hunting equipment and on unusual fox hunts ... hopefully with pictures.

Not a few club officers may have detected a correlation between club activities and club membership. Business meetings gradually smother a club, while license study classes and fox hunts lead to more and more enthusiasm ... and members.

CLUB CLASSES

The bulk of the ham clubs have instituted license study classes and this is rapidly becoming the major interest of most clubs. The number of amateurs the classes are turning out has already had a very positive effect on the amateur licensing situation and the drop off in hams noted for the last few years appears to have been reversed. With more growth of club interest in licensing new hams, the whole Communicator License idea may be out of date long before it ever gets into final rule making. It may turn out that there was no real reason for debasing the ham ticket to get new hams, that a determined effort on the part of the ham clubs was all that was needed. I believe this is true.

If your club has not yet gotten license classes going, raise hell at the next meeting and get things going. If you are short of volunteers to give the code or the theory classes, you could do worse than look into the 73 cassette tapes ... a great many clubs are using these with satisfaction ... and they save an awful lot of trouble ... the work is all done.

Remember the experience of many clubs ... free classes do much more poorly than those that charge a nominal fee. It is a lot easier to drop out of something where you have little investment, so consider maybe a \$7.50 or \$10 fee. This will give the club some extra income for teaching materials. If you think I'm talking in terms of buying cassettes ... I am ... the whole set for the Novice exam only costs \$24 ... and that includes

Continued on page 152

Icom East is in the Southwest – right? And here are the two Dallas chaps behind Icom East: Tom Gentry and Fred Muller.

James F. Reid W8LWS
4 Lawn Street
Ashley OH 43003

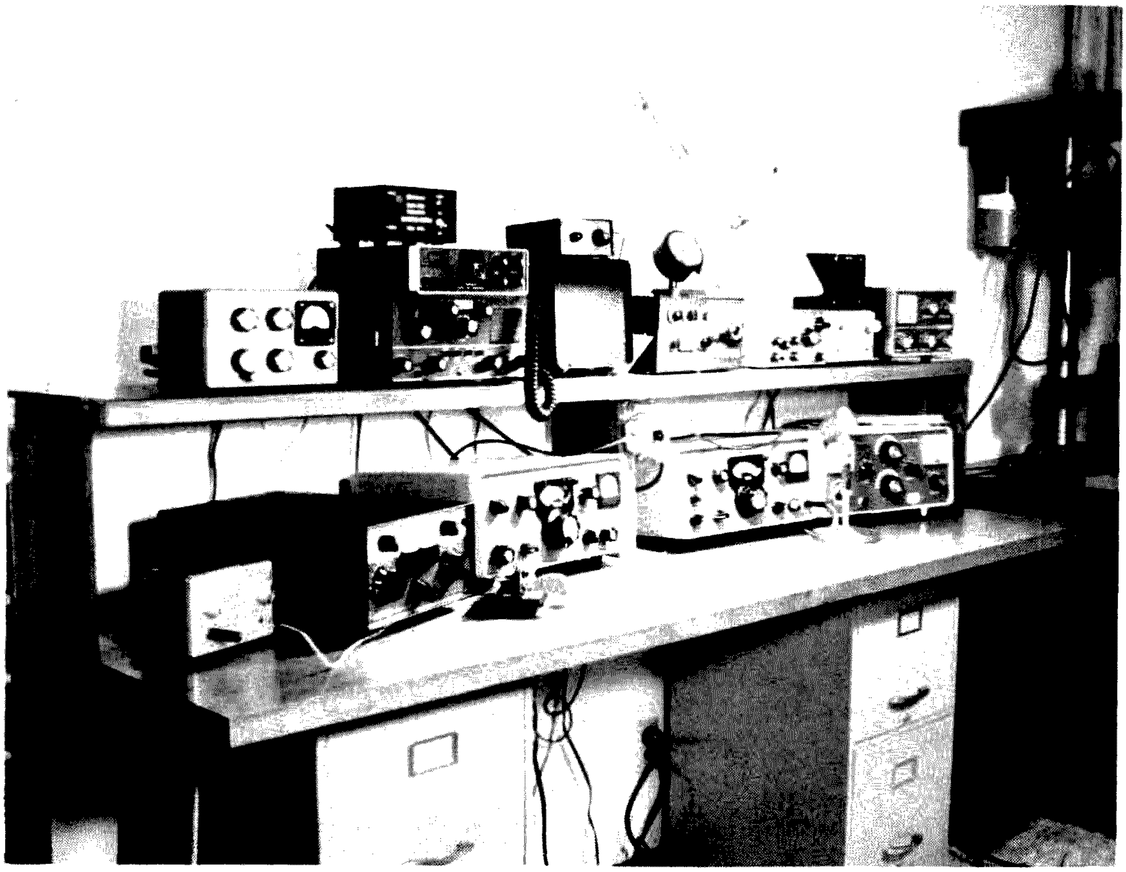
Introducing the Opdesk

Portable and Practical

The following describes an effort to provide an operating console that would fit the following requirements:

1. Ease of construction.
2. Functional efficiency.
3. Minimum fuss to disassemble and move.
4. Cheap, to match my basic nature.

The pedestals consist of two two-drawer file cabinets (approximately 30 inches high). These file cabinets provide space for all the accoutrements that normally are stacked on top of the ham gear. The desk top consists of an unfinished door, i.e., unfinished in the sense that no holes have been bored into it. The top shelf is another door about one foot



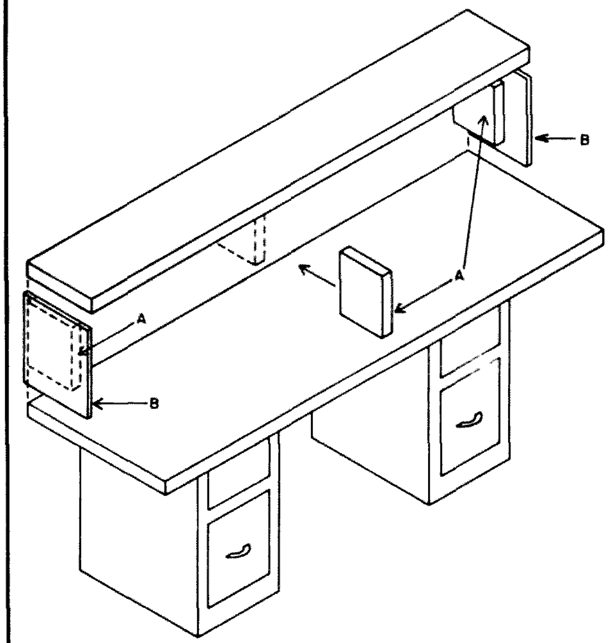


Fig. 1.

wide. I was told that this narrow door was used to construct folding doors. If this narrow door is not available in your area a 2" X 12" will work just as well.

The three pieces labeled "A" are 2" X 6" X 12" and provide support for the upper shelf.

The end pieces labeled "B" are 3/4 inch plywood. The middle "A" piece is held in place by the weight of the equipment on the upper shelf. The two end assemblies (consisting of "A" and "B" glued together with contact cement) are held to the upper and lower doors by long wood screws.

The whole upper desk assembly is not fastened to the file cabinets but rests there of its own weight.

None of the dimensions are critical and probably will vary according to the materials on hand. I would suggest that you get the doors first and then cut everything else to fit. To obtain the doors as cheaply as possible, try visiting one or more lumber stores and ask to see their damaged doors.

You can usually find one or more with only a minor blemish, which can be hidden, and the store will probably part with them for only a few dollars.

A coat of varnish will keep all wood surfaces from becoming dirty and may even convince the XYL to let you bring it into the house.

. . . W8LWS

Bill Hoisington K1CLL
c/o 73 Magazine
Peterborough NH 03458

The 432er Goes Power - Like 1100 Milliwatts

The success of the low-power 432'er on the air, running only about 150 mW rf output from a KMC 2N2502, which is an excellent device but relatively low power, and the availability of the famous 2N3866 UHF medium power device in a low cost amateur version, lead naturally to the addition of one of these (why stop at one?) to the original system. A study of what is needed to do this reveals quite a list.

The Device

Talks with other people and my own studies so far indicate one candidate and one only, for a low cost rig with dry cell battery power for portable and mobile use on 432 MHz.

Heat Sinking

At 100°C, which is only boiling water temperature, allowable dissipation must be cut down to around 60% for the devices to be used, so if we can keep that case (transistor metal can) close to 25°C we'll do better on the air. We did.

Dc Voltage

This is definitely settled at 13½V, as from a car battery and under modulation you have to allow for times two in collector voltage, which is right up to the 28V rating of a lot of devices. The 2N3866 is a real gem in this respect though, with a 55V rating. Shouldn't have any modulation voltage trouble with it.

Gain

From RCA and Motorola work on popular UHF devices, just don't expect 10 dB on 432 MHz. Prepare to be happy with less, like 6 or 7 dB of gain. Plenty of the latest commercial circuits are shown with gains of from 5 to 7 dB.

Circuit

As you will see, this quickly gets tied into the heat sink design because while a "nice little coil" can be used, it wouldn't conduct or radiate much heat. So lots of nice copper strap is used, with solid metal contact from collector out through several inches of copper.

Neutralization

We just might tackle that one yet, which can be real crazy on 432 MHz. We haven't, so far.

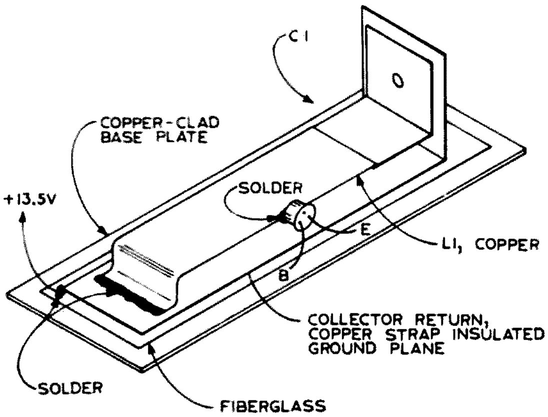


Fig. 1. Good heat sinking at 432 MHz.

Overall Stability

This of course is very important, as you will see later in the section on "Words of caution."

Shielding

We used some. At a milliwatt up front, and 600 mW leaving for the antenna this could be important. But it didn't turn out too badly.

Modulation

We've got a little 3W af amplifier waiting to be used, if the one watter won't do the job. Presumably only ½W is needed.

Dc Milliamps

The total on-the-air-current is getting up there pretty well, but so far not over ½ the maximum of 500 mils indicated by Union Carbide for their lantern batteries. The total came out at 175, so we're still ok on that one.

Collector Efficiency, Final Stage

Most commercial circuits wind up with between 40 and 50%. I'd be happy with that. It actually looks better, like over 50% right now.

Power Out

We're shooting for as much as possible with the 13½V car battery limit. Looks like 600 mW as of now, for one 2N3866 running cool.

Power Measurements

Always troublesome at UHF for a homebrewer amateur, we still managed by using three of those no. 48 bulbs.

There are probably more things to consider, but here are 13 already.

The 2N3866

If there is any transistor that can take the place, in solid state, of the good old 6AF4 tubes for UHF, this is it. It is apparently the best-known device for UHF. For powers of up to a watt (with 28V) at 432 MHz, and low cost, the 3866 is my choice.

Here's what the RCA "Transistor, Thyristor, and Diode Manual" printed in May 1969 has to say about it: "Transistor dissipation, 5 watts." Yes, five watts! However, the case must be kept at 25 for that amount of power. Further, "rf power output, with 28V dc, 1¼W at 450 MHz." Note that 28V dc again. You could use that much dc but you couldn't use it safely with 100% AM. Anyway you've only got 13½V in the car. And you would have to push it with 200 mW input at that. I really don't see where they get that 5W input figure. I'll have to ask the boys down in Somerville, N.J. the next time down there.

At 400 MHz, efficiency is listed as 45%. We appear to be getting over 50% in this model, so that's all right. So far as gain is concerned, I see listed for this item various figures at and around 7 dB or so, again at 28V. We find 6 dB or so, using 13½V. Good enough in that department.

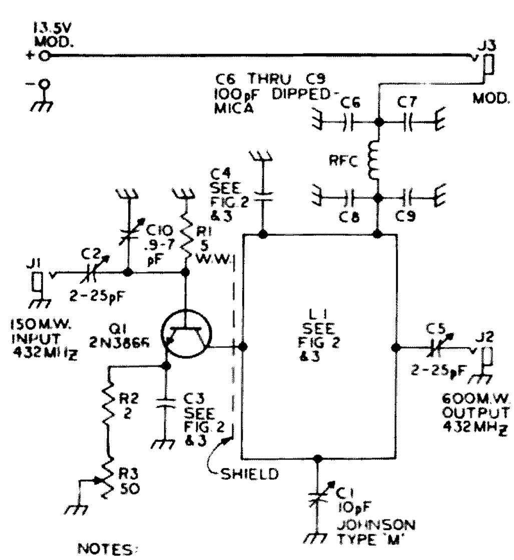


Fig. 2. Schematic of the 2N3866 rf power amplifier, 432 MHz.

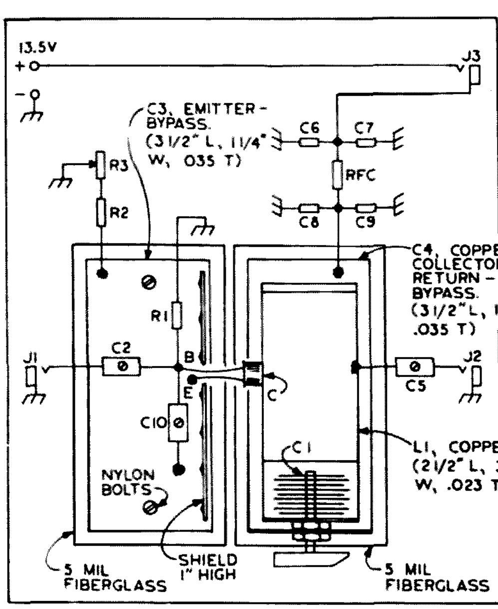
Heat Sinking

This is probably the best place to start the details because that little tin by itself certainly doesn't radiate or conduct much heat. On the other hand UHF circuitry does not do too well with large pieces of metal wrapped around the collector, unless of the proper shape as you will see later.

You could think of a Berlox (RCA trade name for their Beryllium-oxide) collector stud, which is a good conductor for heat waves and at the same time a good insulator for UHF. Quite handy but the cost questions enter then a little too strongly.

But once again, don't worry. We already have a good circuit among several worked out during the development of the 432'er. This is the one using a large copper strap for the collector circuit, soldered to a large copper collector-return ground plane which itself is isolated from ground by an insulating sheet. Figure 1 illustrates this principle.

The collector is soldered directly to L1 (see also Figs. 1, 3, and 4), the copper collector strap, which is ¾ in. wide and high Q. The heat generated in the transistor case can then go directly to L1, and from there with direct metal contact right to the collector-return primary baseboard. Now you have



NOTES:
1. Q1 SOLDERED TO L1 1 1/2" FROM COLD END.
2. C5 SOLDERED TO L1 1 1/2" FROM COLD END.
3. Q1 BASE LEAD IS INSULATED FROM C3.

Fig. 3. Layout and top view of the rf power amplifier at 432 MHz.

dB	Times, In Power
3	2
4	2½
6	4
7	5
9	8
10	10

Table 1. Power gain.

some six or more square inches of copper plus three or four more of insulating sheet contact, which, if needed, can be of mica with silicone grease. I don't think that will be needed though. It wasn't.

Also, as you can see from Fig. 1, the collector return plate is at rf ground and therefore can be of any size needed, as long as you can fit it in. It does have the modulation voltage on it, but at a low impedance, looking like about 170 Ohms at present.

With 1100 of dc power L1 hardly even gets warm enough to feel any heat. More details in the circuit section.

A Word of Caution

While most writers of books on solid state devices, and I am including here manufacturer's handbooks, application notes, specifications, etc., naturally enough like to present the merchandise for sale in a finished form ready for the customer to use, some of them do mention trouble once in a while. And I am among the first to congratulate them on a job well done in producing transistors that do last for years and are repeatable and usable at UHF. It certainly isn't easy. My hat is off to RCA in particular, both for producing good devices, and for being realistic about them. An example of this can be seen in their handbook mentioned above, "Various kinds of instabilities can occur in frequency-multiplier circuits, including low-frequency resonances, para-

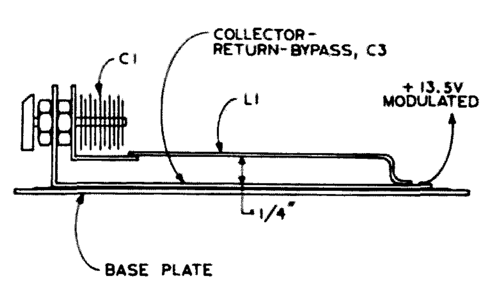


Fig. 4. Side view of the 2N3866 power amplifier at 432 MHz.

metric oscillations, hysteresis, and high-frequency resonances." In particular the "hysteresis" refers to "discontinuous mode jumps in output power when the input *power* or *frequency* is increased or decreased." That last sentence underlines the reason for my continual effort to obtain what I have been calling smooth tuning and operation.

RCA goes on to stress as a main cure for this the use of the grounded emitter. You will notice *all* grounded emitters in my circuits, simply because they work better.

I have to hand it to RCA once more, for their admitting that for UHF and microwaves, plastic packages, with power, have *not* proved satisfactory. They say that the high power combined with the high frequency and the small sizes and small physical separations inside the plastic devices for UHF and up tend to increase the chemical leakage difficulties to a greater extent than with the hermetically sealed units.

That's enough on this subject for now, just don't expect to "solder wire A to post B" and have it perfectly right the first time in solid state UHF. It might, and then again it just might *not*.

Dead Soldiers

As usual I burned one out. However, the methods used (to burn it out) are easy to avoid in this case. 1.) Don't operate without an emitter resistor; and 2.) don't use an old tube power supply in order to see what happens at 28V. I saw all right, operating without the emitter resistor and with that supply, which gave poor regulation (for transistors) at 28V.

I can blame the absence of the emitter resistor on reading too many books. Or is it not enough? I see plenty of circuits *without*

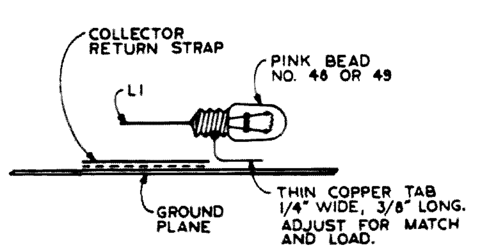


Fig. 5A. Side view of rf power indication.

that resistor but at least with the 3866, don't omit it. It kept locking up at 200 mils with only about 10V on the collector, and I finally found that even a 1Ω resistor in the emitter avoided this special kind of nastiness. You will see 2Ω in the final circuit.

But not before I'd acquired another dead soldier. This came about with that 28V supply, because after checking a lot of gain figures I realized that most of them called for 28V. My actual voltage on the collector at first stood at a low 10, so I plugged in the HV supply and was pushing up the Variac and the 3866 rf output bulbs were beginning to glow like Christmas tree lights, when – POW – something jumped and that was it.

So back to the lantern batteries I went. They say that a man with a house is always coming out of a hardware store. Well, so is a man building a portable battery rig trying for a watt on UHF!

Looking in the books again (it may be fatal but I'm just a hopeless addict I guess) I find most mobile rigs are listed with a 13½V power supply, not just 12V, or 10, as I happened to have. So I cut one of the 6V lantern batteries open and added on a few more cells to the 432'er main supply. It's easy once you open the sardine tin they're packed in, because they're not even soldered together. Anyway, I've got around 14V now, from a battery supply, and things are looking good.

The Circuit

Here we get down to real details, with a few important questions to solve, such as to

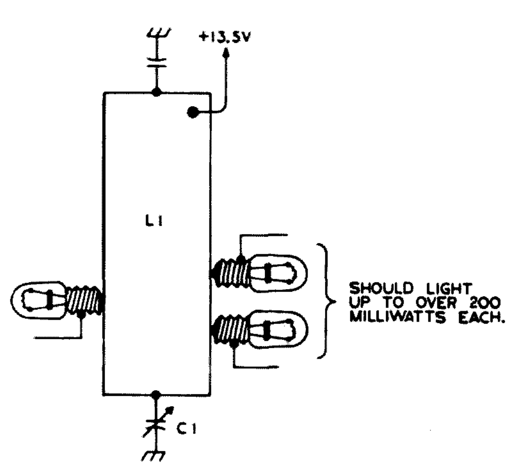


Fig. 5B. Top view, rf power indication.

tune the base or not; value of emitter resistors; collector current, listed as a maximum of 400 mils; what point on L1 to tap on the collector; and where to tap on the output capacitor. All that should give us a good increase over the 150 mW so far available from the 432'er, bearing in mind that the 3866 is a 55V rated transistor and we are shooting for 13½V operation as dictated by a car battery as well as portable use. Figure 2 shows the schematic with component values. Figure 3 has the layout and dimensions, which are very important, of C3, C4, and L1. These are all made out of copper sheet. Figure 4 shows a side view.

The Input Circuit

There is a compromise here, as usual. Read the "Word of Caution" section again for some of the reasons. The base circuit can be tuned completely but you really have to watch for self oscillation then. The compromise bit is furnished by C10, which, in the language of the art, "cancels out the inductive reactance of the base and emitter leads." Sure, it does that, which simply means that the base, C10, and the emitter, are now tuned to 432 MHz. But, due to the fact that there are external leads and "things" which are tied on, like the various internal resistances and capacitors inside Q1, some of which vary as each rf cycle progresses, you can really only hope and try. In this case it did give a little boost to the drive, and makes input cable matching more adjustable. With the use of C2 and C10, Q1 can be driven up to 100 mils, and has a nice collector current dip down to about 20 mils, when L1 is not loaded. This is pleasantly reminiscent of the tube final plate dips that were with us for some 30 years past. It also produces a nice visible spark on applying the pencil test.

After trying various chokes and coil combinations, the base resistor R1, a 5Ω wire-wound Sprague, was settled on as producing smooth, non-spurious, non-lockup tuning. It is almost an inch long and acts as a choke as well as limiting the base-emitter current. It works.

The emitter circuit is of course well bypassed by the copper plate job C3, shown in Fig. 3. R2 limits current to prevent lockup and burn-out, and R3 allows adjust-

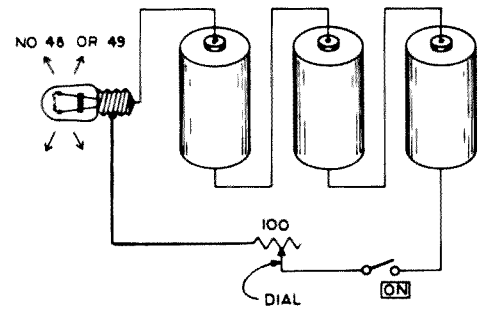


Fig. 6A. Drawing of a sample dial calibration, with 3 dry cells, a 100Ω pot, and one No. 48 bulb.

ment of the collector current which is running around 80 mils just now.

Automatic protection circuits can be used to limit total destructive current, but they require several transistors and diodes and more circuitry, which is not compatible with our main design requirement of the basic power amplifier without frills.

A shield was included as in Fig. 3, and I do not recall any rf feedback oscillation in more than a day of tuning up. The base and emitter leads go through a hole in this shield about 3/8ths of an inch in diameter. Not too critical, I'd say.

The collector is soldered directly to L1, after cutting off the collector wire lead on Q1, which is not used in this 432 MHz rig. Note as mentioned in the heat sinking section that the heat of the metal case of Q1 can now go directly to the copper strap L1 by *metallic* conduction, and then on down to the collector return plate, still by direct metallic conduction, as shown in Fig. 4.

C1 is a 10 pF variable capacitor and with the copper strap L1 shows good sharp tuning when unloaded. It also shows good matching for the transistor impedance and a 50Ω cable output line. Power is taken off L1 through C5 out to J2.

The plus 13½V modulated comes in through J3 and the usual 432 MHz filter previously described. This is ten turns of any wire, wound on a 100K resistor, bypassed by four dipped micas, anywhere from 30 to 1000 pF soldered to ground in four different places.

That about does it for the circuit, and it works!

Rf Power Indication

This has always been a particular problem

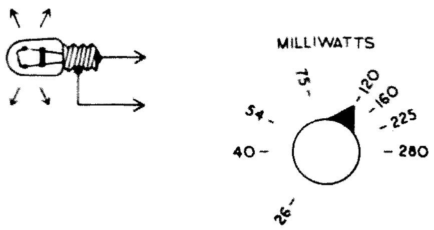


Fig. 6B. Illustration of a low cost rf milliwattmeter.

to accomplish without an expensive power meter, and now with over ½W, it gets even more difficult. To solve it on the bench for the homebrewer I just put more of those number 48 or 49 bulbs on L1, as in Figs. 5A and 5B.

Each lamp is adjusted for the same brilliance by moving the tab capacitors in relation to rf ground. The lamp brilliance is then measured with the "poor man's milliwattmeter" and multiplied by three. If you know an easier and more economical method be sure and let me know.

It turned out to be a total of some 600 to 625 mW, at least. I say at least because the assumption is made that the rf wattage needed to light the bulbs cannot be less than the dc wattage, and may well be higher.

An interesting thing about the 13½V and the evidently low impedance of L1 and Q1's collector circuit, when loaded to 600 mW, occurs when you put your finger directly on the high end of L1. The rf indicator bulbs go dim but you can't put them out with your finger.

Table 1 shows dB versus power just to help with a realistic viewpoint, and shows that as you go from 150 mW to 600 with the 2N3866 you've got 6 dB of gain. As if you didn't know?

Updating the Poor Man's Milliwattmeter

The original one was calibrated only to 150 mW but here we already have over ½W output, and climbing. So, as in Fig. 6A, another D cell was added for a total of three, and the dial recalibrated for use with them, bringing the dc volts to around 4V, and the mils to about 80 for a dc power of 280 mW maximum. A sample calibration dial is shown in Fig. 6B.

With two number 49 bulbs in the rf

output circuit glowing like a flashlight when you look into its beam, I measured over 600 mW rf output so far, by checking each one out at over 300 mW brilliancy. In the final setup shown in Fig. 5 with three bulbs each one checked at over 200 mW.

Battery Power Supply

Just a few words about the question of how much battery voltage is advisable. The entire rig is based on the idea of its being carried portable, mobile, and used at home. The mobile mode dictates the voltage because of the car battery. I am assuming that you do not want to go to the expense and trouble of building something like a dc to dc converter for 13½ to 28V. Most mobile circuits are designed for 13½V so that is the figure we'll use here.

In order to take some advantage of the 55V rating of the 2N3866 I added three more dry cells to the two 6V lantern batteries. These cells are the 500 mils type also, which I acquired by removing them from another lantern battery. This gives about 14–15V under the 175 mA total drain of the transmitter without modulation. The reason I added three cells instead of one or two was because of the voltmeter being used. It was about 1V low. The rig will take the 15V all right, it just means I'll have a shade less power when I plug it into the car battery.

So much for batteries, at least of the dry cell type.

Conclusion

There's not much more to say. Here's a complete dry cell battery rig, 600 mW crystal-controlled output on 432 MHz, modulated, and a good triple-conversion receiver to go with it. The units are breadboard style, but the circuits are all there and work well on the air. I intend to have lots of fun with it; mobile, mountain-top, and in the shack. It is working on dry cells you can buy in any hardware store, runs 1120 mW dc input, and beams from two to fourteen elements have been described, as well as a car beam mount, hand-rotatable. A reasonable balance of power vs battery drain is obtained.

...K1CLL

CONTESTS

from page 14

INTERNATIONAL OK DX CONTEST

Starts: 0000 GMT Sunday, November 9
Ends: 2400 GMT Sunday, November 9

The participating stations work stations of other countries according to the official DXCC Countries List. Contacts between stations of the same country count only as a multiplier, but Ø points. All bands from 160 to 10 meters, CW and phone may be used. (OK stations are only licensed to operate CW on 160 meters.) Cross-band as well as cross-mode contacts are not valid.

EXCHANGE:
Exchanges consist of a 4 or 5 digit number indicating the RS(T) and ITU zone.

SCORING:
A station may be worked once only on each band. A complete exchange of codes counts one point, but three points for a complete contact with a Czechoslovak station (except as noted above for stations in the same country). The multiplier is the sum of the ITU zones from all bands. Final score is then the sum total of contact points times the multiplier.

CATEGORIES:
A – single operator, all bands; B – single operator, one band; C – multi-operator, all bands. Any station operated by a single person obtaining assistance, such as in keeping the log, monitoring other bands, tuning the transmitter, etc., is considered as a multi-operator station. Club stations may work in category C only.

AWARDS:
A performance list of participants will be worked out by the contest committee for each country. A certificate will be awarded to the top scoring operators in each country and each category. The "100 OK" award may be issued to stations for contacts with 100 Czechoslovak stations, and the "S6S" award (and/or endorsements for individual bands) may be issued to a station for the contacts with all continents. Both awards will be issued upon a written application in the log. No QSL cards are required for either award.

LOGS:
A separate log must be kept for each band, and must contain date and time in GMT, station worked, exchange sent and received, points (Ø, 1 or 3), and ITU zone (with the first QSO for that zone only). The log must contain in its heading the category of the station (A, B or C), name and callsign, address and band or bands. Also, indicate the sum of contacts, QSO points, multipliers and the total score of the participating station. Each log must be accompanied by the following declaration:

I hereby state that my station was operated in accordance with the rules of the contest as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief.

Logs must be sent to The Central Radio Club, Post Box 69, Prague 1, Czechoslovakia – postmarked no later than December 31, 1975. A list and map of ITU zones is available for 2 IRCs from the same address.

Please send all contest information, including results, directly to WA1SCX. – Ed.

BE MY GUEST

from page 99

something out with them. As a matter of fact, I think it would be very desirable if the Canadians would track us on CB at 27 MHz.

BOURNE: *Do you have any plans for allowing somewhat of a hobby-type operation on CB, as long as it's going on there anyway?*

HIGGINBOTHAM: We hesitate to use the term "hobby," because we don't want to confuse it with Amateur Radio. But in our proposal in Docket 20120 we did propose to drop the prohibition against chit-chat. I personally am not that hung-up on idle conversations on CB. If they want to get on and talk about their equipment, OK; I just hesitate to call it hobby.

BOURNE: *If they do that, there's even less of a desire, I would think, to get an Amateur license.*

HIGGINBOTHAM: I agree with you.

BOURNE: *Then Amateur Radio would die even faster. If that were allowed, do you think sometime in the future there might be some allowance for Amateurs to operate on 11 meters and talk to CBers, as long as call signs were used by both?*

HIGGINBOTHAM: I haven't thought about that. When we were first talking about Class D within the Commission, I'm absolutely certain that one of the things that we were telling Amateurs – and, of course, that was an Amateur band at the time – was that "You can use the band too." We proceeded from then on to add additional regulations as time went by to tighten up the permissible use of the service. I'm not sure the Amateur community would appreciate a proposal like that.

BOURNE: *If Amateurs were on there talking to the CBers, it could almost give the CBers an incentive to upgrade when the Amateurs tell them what they can do on other frequencies.*

HIGGINBOTHAM: Maybe so. That's a thought.

BOURNE: *Are there any other important proposals or petitions that you are about to act upon?*

HIGGINBOTHAM: We do have the pending petition of APCO to establish one frequency as a nationwide emergency communications channel. We are going to issue that shortly, I think, as a Notice of Inquiry and Notice of Proposed Rule Making, and see what the comments bring in. We are also targeting for a release in July of the Atlanta interservice sharing program that we have been talking about for these several years. The drafting is pretty well along on that, and I think we will be showing it to the Commission probably late in June. This involves land-mobile interservice sharing in Atlanta, Georgia – Parts 81, 89 and 93, the so-called PSIT services.

End of interview.

MORE NEW PRODUCTS

The $9.95 Digital Wonder

If you have ever wanted a digital clock for your shack, now is the time to buy it. Prices on these impressive items have been coming down slowly over the last few years, but when I saw S. D. Sales' recent ad in 73, I didn't believe it.

A clock kit for $9.95??? Well, I now believe.

The kit includes all components except a power transformer and case, and a set of printed circuit boards is available for an additional $3. All of the components are of high quality. The National Semiconductor MM5314 Clock Chip and Fairchild FND-70 LED Readouts are prime units and are guaranteed by S. D. Sales.

The printed circuit boards are G-10 material, and they are all drilled and ready for component insertion.

Assembly

The instructions provided with the kit are more than adequate, and total assembly time should average about an hour or less from the time you open the box to the time your clock is working. The clock worked immediately, and no troubleshooting was necessary. The only difficulty encountered was the lack of clarity on the printed circuit overlay in the kit instructions.

A copy of the data sheets for the clock chip and readouts is supplied with the kit as well; this gives you a good idea of what's going on should you need to troubleshoot your clock, or if you'd just like to know what makes it tick.

Evaluation

The drawbacks of this kit are few. The readouts (.27 in.) may be a bit small if you wish to view the clock from 30 feet away. Of course, you can always substitute larger readouts if you wish. The lack of a case may also be considered a disadvantage by some, but this way you can build it into your station control console or anywhere else you wish.

The first advantage that comes to mind is the price. At a total cost of $12.95 postpaid, including the circuit boards, it can't be beat. The chip, by the way, will read either 12 or 24 hour time, and can be used on 50 or 60 Hz. It can even be used in your car or boat if you're willing to build up a separate time base.

In all, the S. D. Sales Clock Kit is a great buy. If you've been considering building a digital clock, but the prices have been too high, S. D. Sales has just removed your last excuse.

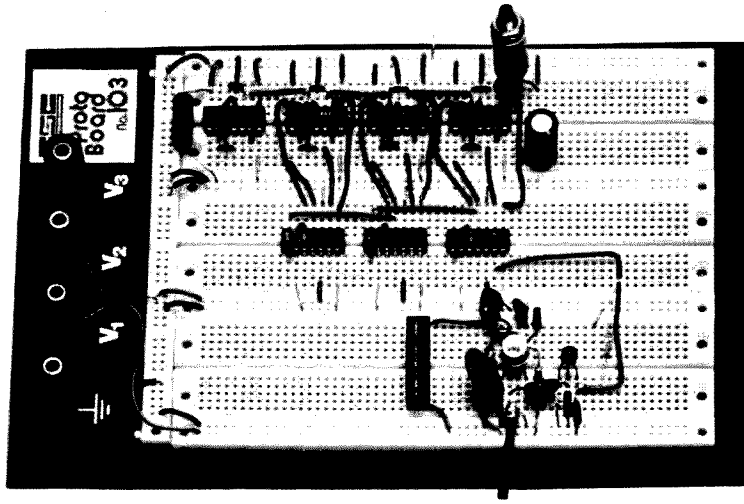
. . . WA2OBH

NEW ANTENNA COUPLER OFFERED BY LEADER INSTRUMENTS

Cleaner signal reception and better transmission at maximum power

output result from the use of the new LAC-895 Antenna Coupler, according to the manufacturer, Leader Instruments Corp., Plainview NY.

The new instrument provides proper antenna matching, virtually removing all TVI problems. Frequency range is 3.5, 7, 14, 21, 28 MHz, amateur band. Input impedance is 50 Ω, while load impedance is 50 Ω or 75 Ω, coaxial cable. Power consumption is 200 W while the insertion loss is 0.5 dB or less. The unit may be left in circuit to facilitate optimum operating capability. Price is $159.95.



PROTO BOARD MAKES BREADBOARDING EASIER

Continental Specialties Corp. has developed a line of equipment to make solid state circuit design easier. Their Proto Boards are rugged plastic with holes spaced to fit DIP ICs, as well as most all other components. Holes are connected to tie points internally, and rows of holes are provided that are connected to bus lines for power supply and ground. Additional connections can be made using #22 wire. Proto Boards come with binding posts for power connections, and there are models available with built-in power supplies.

Socket and bus strips are also available separately, with snap/lock interconnections to make any size board. The Proto Board system makes it possible to try out new circuits without a lot of soldering that could damage ICs.

Continental also makes a self powered Logic Monitor that clips onto the leads of a 16 pin DIP and instantly indicates the logic states of each lead. LEDs simultaneously read out all leads, faster and more easily than with meters. Proto Clips clip on to ICs similarly and simply bring up the leads for easy access. Using Proto Boards and Proto Clips makes design and debugging faster and easier than before, which should be a great help for anyone who wants to try his hand at circuit design or construction. Continental Specialties Corporation, 44 Kendall St., New Haven CT 06512.

Looking West

from page 96

exact figure, but at last count there were quite a few pending with no place to put them — on two, that is. In short order, 220 will be in the same position. About the only really wide open space is to be found on six meters, where LA is served by only one open repeater: WA6UJS on Mt. Wilson. It was a combination of these two factors (the uncoordinated repeaters and the fact that we are plum out of spectrum) that was the reason for the SCRA's approach to the FCC to propose a pilot project between the two in matters of the coordination of 144 MHz and 220 MHz repeaters in Southern California. The idea was to put "teeth" into the decisions of the SCRA's coordination efforts and at the same time provide the individual applicant with the most efficient way to get his WR application acted upon.

To summarize the basic points, as outlined in the June letter sent to the Commission, the SCRA proposes that all completed Form 610 As for VHF repeaters in this area be forwarded to the SCRA Technical Committee for review, correction if necessary, and frequency assignment, prior to being sent to the Commission for their action. After FCC processing, the license would be returned to the applicant with a copy of the SCRA sanction attached. The test period would be one year, and during that time period, if any particular applicant felt that he or they had been dealt with unfairly by the SCRA Technical Committee, the applicant could "redress his grievances" directly to the Commission. During the test period, the SCRA would submit progress reports to the FCC on a regular basis and would follow this with a final report and recommendations at the end of the test. After the one year was up, any restrictions imposed by the test would be off. As of this writing in early August, the Commission has yet to respond to the SCRA proposal, but local reaction has been rather pro among the FM community. If this plan were adopted, it would give the SCRA's decisions a bit of solid backing, and would probably put an end to what we at 73 have come to term the "renegade" repeater. While too many of you who live in smaller communities that are served by a handful of machines with plenty of spectrum to spare might find it a bit hard to believe, the fact is that many of the larger urban areas have reached the point of total saturation on two meters, and, as I said earlier, we here in LA and vicinity will soon face the same situation on 220. 450? . . . I cannot speak for the rest of the nation, but as for the W6 call area, it's been full for over 10 years now.

In discussing this proposal with others, both here and in other parts of the country, the only really negative comment I have heard is that bringing the Commission directly or even indirectly into the frequency coordinating business might just be inviting disaster. It is admitting that we, the "self-policing" amateur service, cannot do the job ourselves and therefore must request outside aid. The thought is that this could lead to more restrictive legislation at a time when we are fighting very hard to liberalize what we are now burdened with. But, do we let Joe Blow just blatantly disregard the rights of the rest of the amateur FM community so that he can have his super ego trip repeater on the air at the cost of an already established system? Will we get to the point where a channel pair on two meters will be the hard won prize for those who show the most contempt for those already operating in that spectrum? Will we be forced to live with confrontation after confrontation until such time as only the fittest survive? I sure hope not.

What alternatives are there, though? One that I have discussed with Wayne seems to make quite a lot of sense. Let's for the moment call it "Right of Redress of Grievances by Repeater Councils to the FCC". Following this thought, if a repeater were to come on the air uncoordinated, cause hardship to already established systems, and refuse to cooperate with the rest of the amateur community, then a given coordinating group that was recognized by the Commission as having the responsibility for coordination in a given area could petition the Commission and request that the license of the system in question be suspended until such time as they were willing to cooperate with the coordinating council and, more important, with their peers on the given repeater subband. First, taking action in this way would show that a coordinator has at least tried to solve the problem before throwing up his hands and running for help. It would require those responsible for area coordination to make every possible effort to find a place for the new system and take an active interest in the general welfare of *all* users of a band. Moreover, it would force a coordinator to carefully follow every minute action in a given situation and be ready to provide the necessary documentation on a matter, should same be requested by the Commission. On the other hand, it would give the operator of the system in question a chance to learn the art of mutual cooperation and that this "art" does benefit all concerned, while at the same time giving said system owner the right to make his views heard by the Commission if he feels that he has a valid reason for acting in the way he has. In other words, it would keep the Commission out of frequency coordination of repeaters and instead only involve them when cases of interference to a given coordinated system was taking place due to the appearance of an uncoordinated "renegade" system. This method would keep the actual policing within our ranks where it must remain, while developing a tighter working dialogue between the Coordinating Council and the FCC. I suspect that there are other alternatives, and if you have anything along these lines, please write to me so that your ideas can be shared with the rest of the nation.

A few months ago I might have said that the time is fast approaching when some action along these lines would soon be a necessity. With more than half a dozen such unsanctioned operations in this area and with who knows how many others in the other crowded urban areas, the time, fellow hams, is now.

SAROC Hawaii: Was it great or was it a bust? I have heard many conflicting reports on this item, but LW was lucky in that it had its own quasi-official observer present in the form of my good buddy Bill Orenstein KH6IAF/6. Bill will use just about any excuse to head west over the blue Pacific for a Hawaiian Holiday, and SAROC Hawaii was as good as any. So while I baby-sat his IC-230, FT-224 and other assorted VHF radios, Bill made the five hour non-stop trek to those beautiful islands. About 10 days later, at 3 am, he showed up back here in LA with a lot to say about SAROC itself and other aspects of Hawaiian VHF FM. We will cover all this and more next month when we see you Looking West . . .

. . . WA6ITF

Caveat Emptor?

PRICE — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

WANT TO BUY early, rare or unusual Morse Keys. Any type, condition. Write VK4SS, 35 Whynot St., West End, Brisbane, 4101 Australia.

FOR SALE Motorola HT-220 5 frequency handitalkie $500 counter, frequency Heath Model IB1102 8 digit 120 MHz $280. Call Loring C. White W1ODI, 26 Boswell Rd, Reading MA. 617-944-0443.

TECH MANUALS — $6.50 each: R-220/URR, SP-600JX, USM-34, GRR-5, URM-25D. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

MANUFACTURERS, Distributors! The Memphis Hamfest will be bigger than ever. The dates are Saturday and Sunday October 4 and 5. Best location possible — State Technical Institute, Interstate 40 at Macon Road. Security. Contact Chairman, Harry Simpson W4SCF, Box 27015, Memphis TN 38127, phone (901) 358-5705.

WHY PAY MORE? FM xtals, Cushcraft, Hustler, Dentron, "W2AU'. Used gear. Write for price list. Ferris Radio, 308 E. Harry, Hazel Pk, Mich 48030 (313) 398-6645.

REGENCY HR-2B in unopened carton. $190 plus +3 UPS shipping charges. Joe Trombino, 940 Alpine Road, Marion IA 52302.

FREE BARGAIN CATALOG. LEDs, ICs, Microphones, Headsets, resistors, Relays, Ultrasonic Devices, Precision Trimmer Capacitors, Unique Components. Low, Low, Prices! Chaney's, Box 15431, Lakewood CO 80215.

WANTED: 7 coils for Millen GDO (set) Gonset GSB-2 with ac, or Echo II. FOR SALE: 2 meter transverter, i-f 20 meters. $100.00. Call or write Jim W1VYB (617) 922-3850.

FREE: 8 EXTRA CRYSTALS of your choice with the purchase of a new ICOM IC-22A at $249. With the 10 crystals that come factory-installed in the IC-22A, this gives you a total of 18 crystals! For equally good deals on Drake, Collins, Kenwood, Ten-Tec, Regency, Swan, Atlas, Midland, Alpha, ITC, Standard, Tempo, Genave, Hy-Gain, Antenna Specialists, CushCraft, Mosley, Hustler and others, write or call Hoosier Electronics, your ham headquarters in the heart of the Midwest and become one of our many happy and satisfied customers. HOOSIER ELECTRONICS, P.O. Box 2001, Terre Haute, Indiana 47802. NOTE OUR NEW PHONE NUMBER! (812) 238-1456.

FOREIGN LANGUAGE cassettes. 2 — 60 minute quality tapes per set. French, German, Italian, Spanish. $6 a set, 4 sets $20. Royal, Box 2174, Sandusky, Ohio 44870.

WANTED: Mobile telephone equipment such as Delco, GE, etc. Also heads, decoders, duplexers. Greg Hyman, WA2OTG, 19 Sicard Ave., New Rochelle, New York 10804, (914) 636-2494.

POLICE AND FIRE Scanner Special — Regency ACT — R — 10 H/L/U 10 channel 3 bands, combined ac/dc 10 free crystals included $169.00 prepaid, dealer inquiries invited, Four Wheeler Communications 10-F New Scotland Avenue, Albany NY 12208.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945-75. Indispensable!)

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester NY 14612.

FOUNDATION FOR AMATEUR RADIO annual Hamfest Sunday, 19 October 1975 at Gaithersburg Maryland Fairgrounds.

SWAN 250 SSB xcvr (mint condition) $200. Johnson matchbox w/remote swr coupler $100. Edgar Kuck WB2ADH (315) 339-0262) 2315-B Matador, Rome, NY 13440.

WANTED — Make, Model and Serial number of stolen ham gear for big list. W7UD, 3637 West Grandview, Tacoma WA 98466.

CINCINNATI HAMFEST: 38th annual — Sunday, September 21, 1975 at the New Stricker's Grove on State Route 128, one mile west of Ross (Venice), Ohio. Flea market, contests, model aircraft flying, food and beverages all day. Advanced tickets $7.00, covers everything; $8 at gate. For tickets or further information: Carl J. Dettmar W8NCV, 8630 Cavalier Drive, Cincinnati OH 45231.

COLLINS: 30S-1 2KW amplifier excellent operating and physical condition, trade for Bendix R-1051B/E receiver same condition. Sid Sidman, 3571 Gresham Court, Pleasanton, California 94566.

HP-65 USERS exchange ideas, programs, methods. Monthly newsletter. Request information and sample newsletter. Richard Nelson, 2541 W. Camden Pl, Santa Ana CA 92704.

VHF ANTENNA 6.8 dB gain, 18' fiberglass w/50' ½" aluminum coax $150. John A. Wheaton, PO Box 182, Williston Park, NY 11596.

CALL LETTER LICENSE PLATES – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate – most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

GREAT LAKES DIVISION CONVENTION – October 10 & 11, State Fairgrounds, Columbus, Ohio. Many activities planned for hams and their families: flea market, forums of all types, Ohio Village tours, ceramics class, etc. $2,000 in prizes include TR4-C & two R4-C's. Advance registration $2.50. Write Mary Gibb W8RVP, 293 Ceramic Drive, Columbus OH 43214.

FOR SALE: HP-45 superscientific with nicads, charger, etc. Condition: new. $265. (201) 233-7068 after 5:00. Ask for Bryan, or write to Box 1237, Mountainside NJ 07092.

MOTORHOME for sale. 25 ft. Sportscoach (RB) – 1973 – excellent condition – many extras. Antennas – 2 mtr. TV, (2) HF – 4 KW generator, sleeps six. $1,500 down, assume loan. Send SASE for more info. W6KHS, 212 Magellan St., Capitola CA 95010.

MEMPHIS is beautiful in October! The Memphis Hamfest, bigger and better than ever, will be held at State Technical Institute, Interstate 40 at Macon Road, on Saturday and Sunday October 4 and 5. Demonstrations, displays, MARS meetings, flea market, XYL entertainment, prizes. Informal dinners Saturday night. Dealers and distributors welcome. Talk-in on 3980, .34-.94 and MARS. Contact Harry Simpson W4SCF, Box 27015, Memphis TN 38127 or telephone (901) 358-5707.

JIG SAW PUZZLES wanted. If you have any old wooden jig saw puzzles in your attic – or run across them at an auction (they go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck apiece for them. c/o 73 Magazine, Peterborough NH 03458. Wood, not cardboard – and complete.

LOOKING FOR JAN 1961 issue 73 Magazine. Please write, stating price, only mint condition. All letters answered. R. H. Wilson, 4011 Clearview Drive, Cedar Falls IA 50613.

COLLINS 30S-1, excellent, new 4CX-1000A, $1050, alpha 374, brand new, in warranty $975, Techtronics 310A with cart $250. Sid Sidman, 3571 Gresham Ct., Pleasanton, Calif. 94566.

RADIO ARCHIVES, amateur ANECDOTES (then & now) solicited for proposed (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 fourth St. N., Mpls., Mn. 55412.

... de W2NSD/1

from page 127

the four tape Novice theory set plus the code intro and 6 wpm back breaker practice tapes.

HAM SKIERS TO MEET

HTs add quite a bit to skiing, cutting down on boredom on the lift lines and while going up in the chair lifts. This last winter hams got together for skiing on quite a few weekends, with up to seven HTs going at times. It was a ball.

The plan is to get as many hams together at Aspen for the January 4-10th week as possible. It should be a lot of fun. If you ski and can get away for the week, bring your HT set up for 146.52 and join the crowd.

There'll be some beginners as well as some gung ho snow scorchers like Chuck WA1KPS of Tufts Radio. If you can make it, drop me a line – I'll be there for sure, complete with HT and a charger. If there is finer skiing anywhere in the world, I've missed finding it. Aspen also has some of the greatest restaurants.

Get your skis out and be there.

SUPER DXPEDITION

Captain Burke of the Windjammer Cruises is looking for a licensed amateur to operate the ham station aboard the Yankee Trader. This is a ten month around-the-world cruise, complete with visits to a lot of very rare spots, skin diving, and loafing. The regular fare for the trip runs about S25 per day – and there is a whopping discount for a ham to help provide phone patches back home.

Contact Capt. Burke, Box 120, Miami Beach FL 33139.

LOCAL NEWSCASTS

Another feature being developed for repeaters is the ability to run off a short cassette on demand with current news of the repeater group. The most used system so far for this uses TT number 9. This is an excellent way to make meeting times and other club events known to everyone using the repeater. It can also be expanded, if you have an interested newscaster, to include the latest ham news flashes. Don't make it too long, as the service can quickly get to be a bore for the more persistent listeners.

. . . W2NSD/1

LETTERS

from page 21

STRAIN DRAIN

Probably ten years ago I typed the invitations to NZART branches in Auckland to hear Wayne Green and then couldn't get to hear him. However, we worked on the air and he sent me a sample copy of *73 Magazine*; I ordered the back copies and have been hooked since. Copies arrive pretty punctually and are very welcome. Always glad to see projects for beginners to do home construction so easily missed as an experience if one sticks to commercial equipment only.

Congratulations on the Study Courses and Code Tapes and their evident success. 73 continues from success to success. Our Public Library has it as its only subscribed radio magazine and one of the local bookshops has copies on sale. I feel, too, that Wayne has a team around him that has taken away the strain of earlier days in turning out the magazine.

Father Phil Keane
Gisborne, New Zealand

FITS THE BILL

Just a short note to let you know that 73 is one fine magazine. Fits the bill perfectly at this QTH. Especially appreciate your construction articles by K2OAW. Keep up the fantastic job.

James Billman WB8MWE
Willard OH

OLD MAGS

My husband, who was W2JRX (and also a radio technician) passed away in May of 1974. We have 73 Magazines from 1964 to 1975, QST from 1942 to 1972 and CQ from 1947 to 1970. A few magazines have been sold for 25¢ each. Could you please tell me if I could sell these or how I should go about it. We also have some CB magazines, as well as radio equipment. Would appreciate any help you can give me, and thanks for your trouble.

Mrs. W. Waterman
55 Lake Ave.
Middletown NY 10940

'VETTE SAVING

On July 11, 1975 at 6:40 am EDT, while mobiling on I-271 near Cleveland OH, my wife and I spotted a towed car on fire (one of many beautiful 'vettes seen that am). Through the fine WR8ABD repeater, Tom K8MMM was contacted. He called the State Police, who immediately gave chase to save the day, and the 'vette.

Ted Holt WB6IPR
Keene NH

SENECA ON THE WARPATH

I have a Heathkit Seneca, which has the controlled carrier modulation which causes the current meter to vary with the modulation. I would like to know if any of your readers would have a circuit which would overcome this movement by the needle, somewhat like the TX86 which had a grid modulation but did not cause these oscillations.

Harry Penders
611 Turf Lane
Conshohocken PA 19428

FORAGING FOR A FRONT END

I am in the process of building a frequency counter using TIL306 and '308s and have got the PC layout for everything but a front end. The counter measures freq. to 100 MHz and I need to go to 300. I have a 95H90 and a 9582, and would like to find out if anyone has used these two devices in a front end and if they have would they be willing to part with the schematic. PC layout is not needed as I have the facilities to do the board layout.

Kirk R. Mellnick
803 Lufbery Dr.
Seymour Johnson AFB
North Carolina 27530

Karl Schulte WA2KBZ

Ham PR vs Chaos

Splashing through the wind-swept lake which had been a parking lot only minutes before, I surveyed the sad, soaked remnants of what had been the grandest

Dale Reif, Rolling Meadows' Woman of the Year for 1975, visited the station and made several contacts (under WB9IDJ's supervision).

parade our city had seen. Soggy floats, all but dissolved into giant, amorphous fruit salads, stood abandoned helter-skelter, while everywhere were bandsmen, spectators, and even clowns dashing for whatever shelter they could find. Trying to bring order to chaos, while braving the incredible torrential downpour, were the town's police and Civil Defense members. All was lost, and the Twentieth Anniversary Celebration of Rolling Meadows, Illinois, was washed out at the height of the festivities.

But not all was lost, for as the door to our park building opened, the musical notes of a CW contact were heard, and on 20 phone, a KL7 was giving congratulations on the anniversary to WT9RMI. This was our town's special event station, set up to bring added publicity for both the town and our new Civil Defense Radio Club, which sponsored the operation.

We had an omen of bad weather the night before, as Doug (WB9IDJ), Rich (WB9DED), Ken (WB9QLD), and myself set a record for erecting antennas, with incentive and inspiration being provided by an ominous and rapidly approaching electrical storm. Convinced the weatherman wasn't fooling, we luckily elected to set up inside the park HQ building, rather than in a tent. A good choice, I thought, as I stood dripping in the doorway, for the operators were the only folks around who were warm and dry, and whose plans were not ruined by the rain.

The Anniversary station was the idea of WB9IDJ and Merril Wuerch WN9PRB, who is the Director of Civil Defense as well as an Alderman for the city. Being enthusiastic about ham radio, and wishing to establish a Rolling Meadows radio club, sponsored by Civil Defense, Merril gave the go ahead.

A letter was written to the FCC requesting the call WT9RMI, for the *t*wentieth anniversary of *R*olling *M*eadows, *I*llinois. Arrangements were made with the park officials for permission to operate on park grounds adjacent to the parking lot where most of the people would be, to provide for maximum exposure. Special QSLs were designed for the station, and equipment,

Karl (WA2KBZ) and Pat and Don Whiting (balloon owners) get ready for test flight. Note PR on side of basket.

antenna materials, and operators were lined up. We were all set to go – except for the license; although ample time had been allowed, there was still no sign of it, and the time was growing short. (There is no such thing as applying for a license too early.) A call to the FCC reassured us; it was in the mail, and in fact did arrive in the nick of time.

The actual operation was a success, and achieved our goals of both helping the town to spread the word of the anniversary and to kick off our new club – not to mention having a lot of fun doing it! A nice side effect was the front page PR received in the local newspaper, and the surprise "Balloon Aeromobile" operation. That's an example of one of the ways to add a little "zing" to a club event.

As our main operation got under way, WB9IDJ and I noticed a hot air balloon being set up behind our "shack". Having the same idea, we approached them with a Regency HR-2A, equipped with whip and battery, and with our best charm. After presenting our request to go up with a radio,

we waited anxiously for the owners' decision. Don and Pat Whiting, owner and chief pilot of the Infinite Horizons Balloon Service (Mt. Prospect IL 60056), nice folks that they are, agreed and even became curious about ham radio. The two sports make a natural combination. Flying at an altitude of roughly 200 ft, we were able to make some long haul (for Illinois and low power) contacts, while enjoying the unique thrill of a balloon ride! We hope to try this again in the future, perhaps in conjunction with races.

Returning to the main operation, we worked 25 states, including Alaska, and a number of European, Asian and Central American stations, including Russia, Panama, and Mexico. However, one of the most interesting QSOs had to be the contact with another special events station, WI9NDY, who was operating at – you guessed it – the Indy "500".

In closing, thanks should be offered to the many amateurs, officials, and folks in general who helped to make this special event possible.

. . .WA2KBZ

Gloria Dawn Patterson
27046 Freeport Road
Palos Verdes CA 90274

Busy Hams Benefit Baja

"Buenos dias, mis amigos . . . XE1ZQ/portable, San Vicente." Queta McFarland's crisp, feminine voice is loud and clear. All guys on 3855 MHz, "The Taco Net," eagerly click their mics, hoping to be first. "W6WMO, Hal, here . . . greetings, Queta" . . . "W6YSP, Wes . . . how's the school coming?" . . . Others greet her: JC (K6MVF), Nick (K6DBJ), Mac (WA6DTB), George (W6JC), Ed (XE2EBE), Aida (XE2BY).

Queta knows our limited Spanish, so switches: "The kids are done digging the ditches for the water pipe. We're ready for you . . . W6HCD, are you there, Nash?" – Sure he's there! He's president of Foothill Chapter of "Flying Samaritans," in charge of San Vicente school construction work. "Hola, Queta, como esta?" (Nash took a 6-weeks leave of absence from JPL where he works on Technical Staff, to attend a concentrated Spanish course in Mexico.) "We'd better ask W6RYX if POA's plane is ready for next weekend . . . you there, Pat?"

The QSO goes on throughout the evening. Plans are made to pick up tools, parts and

From left: Nash W6HCD, Mrs. Irene Peterson (sister of Pat), Pat W6RYX, checking through airport customs with Mexican customs official and two workers heading towards San Vicente for work weekend. People of Action's airplane 3681-B keeps busy most weekends flying personnel and equipment as coordinated over Taco Net and ham radio between Mexico and United States.

medicines. Dates are set for work weekends. You'll find these hams here most every night. Think of the time, fuel and expenses saved! Hurray for amateur radio! Queta's using a donated rig, an antenna built by Nash and the rig tuned and serviced by Pat. This amateur radio station is the only means of communication for efficiently bringing down proper equipment and manpower. Through its use, San Vicente has a school and a water system built to U.S. standards. The 4000 feet of plastic pipe were laid in ditches dug by boys from the school, under Queta's supervision.

It's gratifying to see 73 Magazine spread its horizons to include more than technical data from amateurs. I agree with Wayne, our ham guys are gutsy! I'll bet most of you are involved in some philanthropic endeavor right now. When you have an eyeball with your group, aren't you amazed at the many skills of hams? If you're not a flyer yourself, most likely the fellow beside you is – or a boater – a photographer – or motorcycle buff. I've learned a lot about hams while sharing a cup of coffee, a pot of chili at a picnic or a swap meet. A gal doesn't have to send CW, or read a schematic, to talk their language. And what a mixture of talents . . . intellects . . . with the sincere desire to help others!

Just mention, for instance, a mission to Mexico coming up in Baja. The engineer drawing the diagram on his napkin suddenly stops. The photographer quietly lays aside his viewer and slides. The pilot's story is cancelled. "What can we do to help?" "Does your plane have an extra seat?" There's a couple of active hams in Southern California who will quickly get you involved; you heard them on the Taco Net, but let's get a little better acquainted with them.

Nash W6HCD has been an active ham for many years. You couldn't count the number of hours he spends in the shack, shuffling notes, coordinating projects, contacting pilots and hams re Mexico trips. "You'd be surprised," he says, "how many pilots are hams, and how many hams hold highly skilled jobs. Yet, busy as they are, they answer yes when I need a landscape layout, architectural design, water analysis or just plain labor."

Queta McFarland, left, and workers smile as Bob Carbinier brings in huge flow of water from newly installed well at San Vicente, Baja, Mexico – made possible by amateur radio operators' coordination between Mexico and U.S.

Pat W6RYX got his amateur license at age 15. Now he's executive director of "People Of Action," a non-profit group which owns a twin Bonanza airplane. Pat tells us: "POA simply means we're a bunch of people who believe in action; in fact, our slogan is 'serving others worldwide.' We're a tool for *all* organizations."

These two have now completed the QSO by setting a firm date for a work weekend in San Vicente. Should we go along? You have to get up before the sun, to be on time for 3681-B's departure. We clear customs at Tijuana, then 40 minutes later, our ETA is confirmed as we sight the ham antenna above the school grounds. Making a pass over the village to announce our arrival, Pat carefully descends over the hill at the end of the runway and lands "on the numbers" of the short, bumpy, dirt strip of 1900 ft., only 3/4ths of which is usable.

Work starts right after Queta's refreshments. Pat and Nash get busy on the rig replacing the flat final tubes with some donated by Nash. They check the frequency calibration with Pat's General Radio frequency counter model 1192-B; tune the rig

San Diego's Town & Country Hotel hosted July's Colegas y Amigos Breakfast, where 200 hams met to discuss cooperation between Mexico and U.S. Shown above with VHF Engineering 2 meter repeater display for Ensenada Amateur Radio Club XE2EBC, left-to-right, Father Ryan W6HBP, Pat W6RYX, Earl K6SMT, Al XE2AVG, and with microphone, Fred W7VQQ observing operation of the repeater. "Dos Metros Amigos" will participate in Mexican fiestas, where American hams can share the use of the Ensenada repeater.

using his Bird - 43 Watt meter. Then contact is made with Mexican hams for any emergencies. Meanwhile, Bob Carbinier, engineer for Waterworks & Utilities Div. of LA., loads supplies into the truck; Leonard Shortlund, Assoc. Harbor Planning Coordinator for L.A. steps on the gas; and they're gone for the day. They'll check the flow of water from the gas driven centrifugal pump, connect the pipe and storage tank. Volunteers from San Vicente listen carefully as they're taught how to lay the pipe and finish the work necessary before our next trip down.

I take my camera and notebook to record the story. The school portrays the results of many Americans who have left personal pleasures and families behind, to help repair generators, set up a clothing shop, donate supplies, etc. There's a small fence around one dormitory – installed by kids from Nash's church one weekend. You can feel their pride as I snap pictures and talk to the natives . . . But daylight ever ends too soon; night is at hand; no more pictures; work still undone. There's always more work than personnel!

Darkness brings a weary, dirty and hungry crew to Queta's. Did you ever eat "cactus burgers?" Mmmmm . . . served with minudo soup, frijolis and topped off with hot apple pie – an American flourish learned from Queta's late husband, Tico. A call from the ham shack indicates stateside hams are inquiring as to our safe arrival. While the "Taco Net" is in progress, a few of us are off to attend an all night fiesta, invited by one of the workers to his wedding party. Here, too, like the day itself, the night passes much too quickly.

These work weekends in Baja are the finishing touches of projects that germinate over the ham frequencies. Most weekends Pat keeps 3681-B's luggage space loaded

with repaired rigs, antennas and parts. Nash also encourages nurses, doctors and workers to cover short-distance villages by car (a good excuse for use of the portable rig!). They drive many miles from Southern California to Tijuana, Guadalupe Valley, El Testerazo, Ensenada, San Vicente, Colnett and other small villages.

"Well, we must go . . . can't get in too late." (There's one in every crowd!) The ham shack gets straightened, operation manual updated, tools loaded in the airplane. All passengers settle deep into the comfortable seats, as we dip our wings farewell to San Vicente. Another mission to Mexico is completed . . . thanks to the miracle of two-way radio, and to the active, aggressive and astounding amateurs we call "hams."

. . . PATTERSON

If you want to get involved in some of this, here's where you can get information: Pat Patterson, "People of Action", P.O. Box 2352, Palos Verdes, CA 90274; phone (213) 541-7379. – Ed.

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October – 1975

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5	6	7	8	9	10	11
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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	7	3	3	3	7	7	7A	14	14
ARGENTINA	14	7	7	7	7	7	14	14A	21	21	21	14A
AUSTRALIA	14	7B	7B	7B	7	7	7	7	14B	14B	14	14A
CANAL ZONE	14	7	7	7	7	7	14	14	14A	21	21	14A
ENGLAND	7	7	3	3	7	7	14	14	14A	14	7A	7
HAWAII	14	7B	7B	7	7	7	7	7B	14B	14	14A	14
INDIA	7	7B	7B	7B	7B	7B	14	14	7B	7B	7	7
JAPAN	14	7B	7B	7B	7	3	7	7	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14A	14
PHILIPPINES	7A	7B	7B	7B	7B	7	7	7	7	7B	7B	7A
PUERTO RICO	7	7	7	7	3	3	7A	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7B	7A	14	21	21	14	14	14
U. S. S. R.	7	3	3	3	7	7B	14	14	14	7B	7	7
WEST COAST	14	7	7	7	7	3	7	14	14	14	14	14A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	7	3	3	3	7	7	14	14	14
ARGENTINA	14	7	7	7	7	7	7	14	21	21	21	21
AUSTRALIA	21	14	7B	7B	7	7	7	7	14B	14B	14	21
CANAL ZONE	14	7	7	7	7	7	7	14	14A	21	21	21
ENGLAND	7	7	3	3	7	3	7B	14	14	14	7A	7B
HAWAII	14	14	7B	7	7	7	7	7	7B	14	14A	14A
INDIA	7A	7A	7B	7B	7B	3B	3B	7A	7A	7	7B	7B
JAPAN	14	7A	7B	7B	3	3	3	7	7	7B	7B	14
MEXICO	7A	7	7	7	7	3	7	7A	14	14	14	14
PHILIPPINES	14	14B	7B	7B	3B	3B	3B	7	7	7	7	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14	14A	14A	14
SOUTH AFRICA	7	7	7	7	7B	7B	7A	14	14A	14A	14	14
U. S. S. R.	7	3	3	3	3A	3	7	14	14	7B	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	7	3	3	3	7	7	14	14	14
ARGENTINA	14	7A	7	7	7	7	7	14	14A	21	21	21
AUSTRALIA	21	21	14	7B	7	7	7	7	7	14B	14	21
CANAL ZONE	14	7	7	7	7	7	7	14	14A	21	21	21
ENGLAND	7B	7	3	3	7	3	3B	7	14	14	7A	7B
HAWAII	21	14A	14	7	7	7	7	7	7A	14	21	21
INDIA	7A	14	7A	7B	3B	3B	3B	7	7	7	7	7
JAPAN	14	14	7B	7B	3	3	3	7	7	7B	7A	14
MEXICO	14	7A	7	7	7	7	3A	7A	14	14	14	14A
PHILIPPINES	14	14	7B	7B	3B	7	7	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	7A	7	7	7	7B	7B	7B	14B	14	14	14A	14
U. S. S. R.	7	3	3	3	3	3	3	7	7A	7A	7B	7B
EAST COAST	14	7	7	7	7	3	7	14	14	14	14	14A

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

73 amateur radio

November/December 1975
TWO DOLLARS

BIG DOUBLE ISSUE

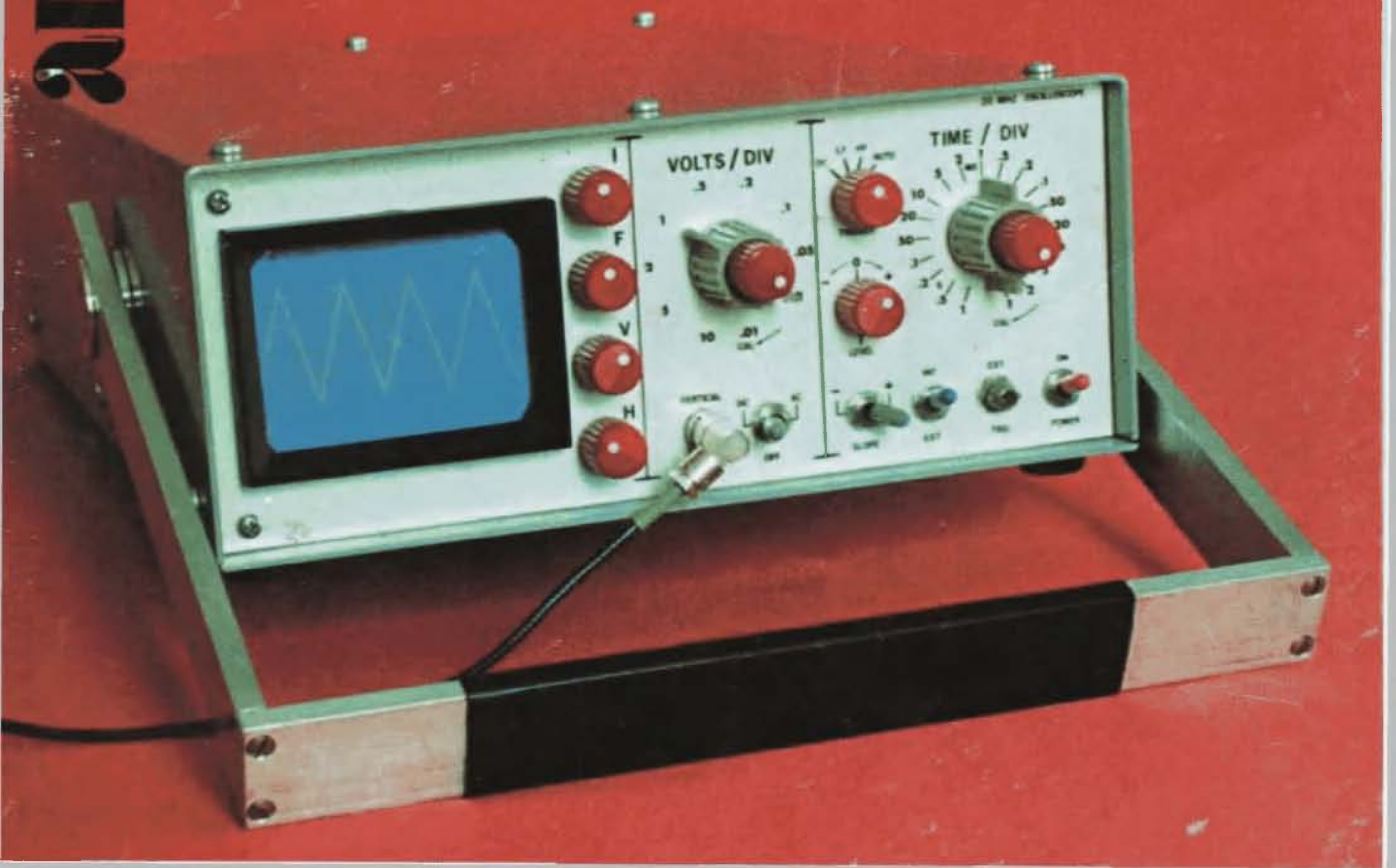
Flip Flops Exposed

Transmission Lines Made Simple

ATV Breakthrough

Interview with Hitler

Eyes for Your Shack



73 amateur radio

#182 NOV/DEC 1975

COVER: WØACR's "Eyes for Your Shack." Article begins on page 74.

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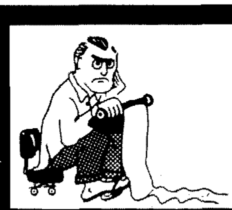

NEVER SAY DIE

. . . de W2NSD/1

EDITORIAL BY WAYNE GREEN

Johnny Johnston as Chief of the Amateur Division . . . there could hardly be better news for amateurs.

THINGS ARE NOT ALL BAD DEPARTMENT

As a matter of fact, things could hardly be better as far as the latest FCC news is concerned. There has been a serious problem with the amateur division of the FCC . . . Johnny Johnston had been transferred to another branch in order to give him an increase in rank, losing amateurs one of the most dedicated and fair licensed hams in the FCC from the amateur division. Then came the "resignation" of Prose Walker, leaving the division with no one in residence to make decisions. This almost totally constipated all actions pending.

The first breakthrough was the appointment of Joe Johnson to fill Johnny's old spot. Then came fantastic news . . . Johnny Johnston was back as Chief of the Amateur Division, filling the Walker chair! There could hardly be better news for amateurs. Johnny is well known for being seriously interested in following the concepts of Chairman Wiley toward a minimum of regulation . . . and he is also known to be very accessible and open to new ideas. No rigid ideas . . . no arrogance . . . an ideal choice.

One more hot news flash . . . Charlie Higginbotham, the head of the Safety and Special Services . . . Johnny's boss . . . who is also well known for his accessibility and belief in a minimum of regulation . . . just got his ham ticket, W3CAH, and will be getting on the air. Having talked a bit with Charlie I think I can say that you won't have to watch yourself . . . he's into hamming for the fun of it, not to be an FCC monitoring post. Anytime you run into someone special you can louse up ham radio for him by making a big deal of his specialness . . . you'll do best if you let him know that you know who he is (we all have egos), but other than that treat him as just another ham . . . and that goes for King Hussein, Arthur Godfrey, on down. One of the worst possible things you can do is frantically call him for a "contact." Lay off!

THE REPEATER HOBBY— AN EGO EXERCISE

Common sense, as it has a way of doing when either money or egos are involved, has taken a nose dive in the repeater field. The plain fact is that there are a lot more repeaters in many areas of the country than are needed.

Despite those lovely numbers in the Callbook showing over 250,000 licensed amateurs, there are more like 120,000 actually active. Of that number about 50% are involved with FM and repeaters. Thus, with an average of about 30 users per repeater, it is no wonder that most of the repeaters are silent 95% of the time — there just aren't enough FMers to support all that mountain hardware and keep it in use.

Perhaps we can look forward to . . . 60,000 "active" repeaters, each with its own control operator waiting hopefully for a user to come along.

It used to be that a group of fellows would get together and decide to put a repeater on the air — now it only takes one. Perhaps we can look forward to the time when we have 60,000 "active" repeaters, each with its own control operator waiting hopefully for a user to come along.

Put it this way — if you're into FM you've talked over several repeaters by now — how many times have you heard a repeater owner ever using anyone else's repeater? Rare indeed.

My recent visits to Salt Lake, Phoenix, Albuquerque, San Antonio, Dallas and New York have done a lot to convince me that we have a whole lot more repeaters than we really need. We just don't have enough FMers to keep even half of them active.

To understand how this all comes

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FOR YOUR EYES ONLY

Required reading —
by Dr. Thomas A. Reilly W3GAT/2
and Calvin McCarthy.

There has been a tremendous proliferation of integrated circuit devices in the past few years. Take a look at the ads in this magazine. You will see numerous columns of numbers designating the many types of integrated circuits available to the amateur. There was once a time when these ads included a brief description with each circuit, but now this is infrequent. There is a great deal of information available on ICs, much of which has recently been appearing in this magazine. As of early 1975, there were over 16,000 devices available from about 80 manufacturers. A major problem for the amateur further frustrating his desire to obtain information is that these companies are frequently reluctant to send materials to people who are neither engineers nor work for an engineering company.

I found myself beginning to want a single source of integrated circuit data. Having such a data source would make it easy to become familiar with the available ICs as well as to identify those in the ads. It would be possible to determine those which could simplify a project in order to make it easier to complete. Because there is no single source of information that contains all of the varied digital and linear circuit data, I've attempted to develop a bibliography of readily available books which will provide most of the required information.

I did not attempt to review everything I have found. Rather, I hoped to present a useful summary of IC information readily available to the amateur user and yet not so expensive that he wouldn't be able to afford to buy the circuits.

THE TTL DATA BOOK
LCC4111, 640 pages, $3.95.

SUPPLEMENT TO THE TTL DATA BOOK
LCC4161, 400 pages, $1.95.
Texas Instruments, PO Box 3640 M/S 84M, Dallas TX 75285.

These two books are by far the most useful to the experimenter who uses this common family of digital integrated circuits. There is a functional index and selection guide so that it is possible to select a device having a particular speed, power and logic function. Also included is a cross reference between Texas Instruments and other IC manufacturers such as National Semiconductor. These books include an excellent description of the TTL family, including circuit ratings, unused inputs, and driving and input current requirements. There are 75 small scale and 175 medium and large scale devices in the first volume and 171 in the supplement, including Schottky limited ICs. This represents 54 logic classes of ICs. These volumes are also particularly useful because of both the clear truth tables for many circuits and the liberal application notes.

LINEAR AND INTERFACE CIRCUITS DATA BOOK
Texas Instruments, LCC4151, 688 pages, $3.95.

This book includes data on eight classes of integrated circuits, including operational amplifiers, voltage regulators, voltage comparators, video amplifiers, and special functions such as line drivers. It contains data on 242 devices.

Incidentally, Texas Instruments does provide a number of other books on optoelectronics, transistors, diodes and power semiconductors for about the same cost.

COS/MOS DIGITAL INTEGRATED CIRCUITS
SSD 203B, 527 pages, $2.00.
RCA Solid State Division, Box 3200, Somerville NJ 08876.

This book contains complete data and related application notes on all CMOS circuits (CD4000 series) currently manufactured by RCA. It has data on 60 ICs and 18 application notes. Information is provided on voltages, unused inputs, and interfacing with other circuit families. A very useful section describes how to handle this type of circuit so as not to blow it out with static charges. The 1975 volume is said to contain data on about 90 circuits. This book is the most complete CMOS data source that I've been able to find.

LINEAR INTEGRATED CIRCUIT BOOK
800 pages, $3.00.
Motorola Semiconductor Products, Inc., PO Box 20924, Phoenix AZ 85036.

For the curious, Motorola offers this fun type of book. It includes data on about 200 circuits, but each circuit is so different. There are op amps, voltage regulators, analog multipliers, modulators, detectors, DA and AD converters, TV and hi-fi circuits, and many others. Many of these can be readily adapted to IC hobby and amateur radio use. Some of these are fantastic devices but I've unfortunately seen too few amateur ads offering these circuits.

MCMOS DATA BOOK
Motorola, 372 pages, $2.50.

Also for the CMOS hobbyist, this book contains data for 69 devices in the MC14000 family of ICs. Design information on power supplies, interfacing and thermal and static charge precautions is also included. Much of the information is contained in the RCA data book, although some of these circuits are different.

PHASE LOCKED LOOP SYSTEMS
Motorola, 180 pages, $2.00.

Those interested in two meter FM already know something about crystal synthesizers. This book tells everything you ever wanted to know about phase locked loops. If you can manage simple algebra you will be able to

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BE MY GUEST

Visiting views from around the globe.

A Hobby That Helps

Ham radio operators come in two categories. Some like to tinker. Others like to talk.

Those who tinker build their own equipment from kits. They talk to other amateur radio operators about how certain receivers work in thunderstorms or which way the antenna should point. Studies show that 49 percent of the conversations on ham radio bands deal with the technical aspects of radio.

Talkers, however, usually buy their equipment ready to go. They become ham radio operators to "meet" people by dialing through the available frequencies until they find someone to talk to. They find excitement in striking up a conversation with a businessman in Japan, a teacher in South America, or a salesman from Topeka.

Bruce Frederickson, Pastor of First Lutheran Church at Mount Ayr, Iowa, and ham operator number WAØCAE, is a talker.

"All ham radio operators are amateurs," he says. "That means each of us has another interest in life. Our mutual interest in radio is the starting point. Then the conversation can go into any direction – depending on the person I happen to meet."

Pastor Frederickson frequently has regular conversations with commuters who have installed equipment in their car to make a profitable use of time spent on the road. (The Iowa pastor also has car equipment as well as a "radio shack" in the parsonage.) He has regular conversations with lawyers, sales representatives, and other ministers.

Invalids often become ham operators to have communication beyond the sick room. For them a call to WAØCAE is like a visit from the pastor.

"Not long ago I met a man from Rhode Island who was recovering from a serious operation," says the pastor. "As we got acquainted he told me he had no faith, and to him the Bible was nothing but garbage.

"But we made an appointment to meet again," he continues. "As we continued to visit, he asked me to pray for him. Later he told me he was going back to his church."

The Lutheran pastor's hobby has also added to his ministry in the congregation. He regularly visits with Walter Schramm, a support person for Lutheran Bible Translators in Monrovia, Liberia, West Africa. The Schramms are originally from Red Wing, Minn., and have a daughter, Robin, who attends St. Paul's College at Concordia, Mo.

Since West Africa is one of the countries that allows phone patches (others are all Central and South American countries, Jordan, Israel, and Canada), the Schramms can contact Pastor Frederickson on the radio. He then calls Robin on the telephone, and the family can talk via a combination of phone and radio for only the cost of a phone call from Mount Ayr to Concordia, Mo.

The phone patch helps both the missionary family and members of First Lutheran Congregation. Church members have become more aware of mission work in Africa.

They also have had contact with Larry Johnson, a Lutheran missionary in Goya, Liberia. Using the ham radio with a phone from the parsonage to the church, the women of First Lutheran heard Mrs. Johnson explain the activities of a missionary family in Africa.

Robin Schramm once visited the congregation in Iowa and talked about her life as a teenager in Africa. During their furlough later this year, the entire Schramm family plans to spend a week at Mount Ayr.

"Because our congregation is a new mission – we just dedicated our church in October 1974 after worship-

you betcha!

The Old Timer was by last week and one of the Legion of Hand-Wringers cornered him. "Tell me," this one said to the Old Timer, "what possible pleasure is there in working DX? Why, I listened to some DXers a couple of weeks back and it was absolute bedlam! Absolutely!"

The Wringer paused in anticipation of a comment, and, when none came, proceeded onward on the path of righteousness. "Why, it seemed that there was hardly a gentleman in the whole group, and if there was one, he certainly was submerged. Tell me! Tell me why supposedly mature and rational people would engage in such tumultuous battles just to work a new country. There must be a reason that you can explain to me. Just why do they do it?"

The Old Timer was silent for a bit, and, when the Wringer showed signs of starting again, he raised his hand to forestall further questioning. "Maybe they enjoy it," he said, and that was it.

There will always be questions when one applies his own standards of behaviour to others, and one of the eternal truths is that only a true-blue DXer can understand another DXer. There is always joy in battle and pride in the scars of battles past, but the best thing of all is to get through that pile-up and work that station. Rollerball all the way!!! You betcha!!

Reprinted from the West Coast DX Bulletin, *August 26, 1975.*

ing in a chapel in the parsonage for many years — we need this contact with a mission program overseas," says Pastor Frederickson.

"We have a lot of evangelism to do here. Talking to people like the Schramms and Johnsons helps us see the need in our area," he continues, "and I hope we are also encouraging our missionary friends."

The Iowa pastor is glad to make phone patch connections with missionaries for their families. However, the connections can be made only in those countries that allow "third party" contacts.

Pastor Frederickson also reminds those who would like to contact someone via ham radio that the system is not like making a phone call. He cannot call someone unless the person is expecting the call and has a receiver set at the right frequency and the right time. All conversations on ham radio must be either by accident (talk to anyone you happen to bump into) or by appointment.

Special interest groups can form "networks" by agreeing to tune in an established frequency at an appointed time. Several missionary groups have networks; so they can depend on ham radio for regular communication.

Ham radio messages may not be used for business — to make sales, place orders, or compete with professional radio. Music may not be played on frequencies reserved for amateur use.

Like all ham operators the minister feels a responsibility to be at his radio during natural disasters anywhere in the world. During the December 1973 earthquake in Managua, Nicaragua, he handled over a dozen calls from people in Central America who wanted to assure relatives in the U.S. that they were not hurt.

"Generally we accept phone patches only for our own area since that keeps down the price of long distance phone calls. But in a crisis like that I took every call I picked up. Of course the conversations were always in Spanish; so I didn't get any firsthand reports of the quake."

Pastor Frederickson received his Novice license and bought his first equipment when he was in junior high school.

"It's still a hobby," he says. "Even though I have found ways to use it in parish ministry, I'm not suggesting that every seminarian apply for a ham license.

"But there are ham operators in every community. (In the U.S. there are almost 300,000 hams.) A contact with a ham could add to the mission education program in any congregation."

WAØCAE conducts another one of his many phone patches for overseas missionaries.

Reprinted from The Lutheran Witness, *The Lutheran Church-Missouri Synod, 500 N. Broadway, St. Louis MO 63105, August 3, 1975.*

PL: A Good Idea

15 kHz splits are not the only solution to overcrowded channels. Bill Mengel WA8PIA, president of the Ohio Amateur Repeater Council, presented a plan that would make more efficient use of at least our underutilized channels, if not every two meter repeater channel.

Very simply, the plan calls for every repeater to go to tone-coded squelch (it's called "PL" around here), with two PL decoders. One of the PL decoders would respond to a specific frequency designated for that area (and all the repeaters in that area would use the same PL frequency). The other decoder in those repeaters, and every repeater in the country, would respond to a "universal" frequency (Ohio recommends 100 Hz, 1z). All the repeaters in an adjacent area would respond to 100 Hz and some different code.

In practice it would work like this:

Base stations. A base station working a local repeater would select the local PL code; thus, he would not key the nearby repeater sharing the channel, only the local machine. If he wanted to use the other nearby repeater he would select that repeater's local code, and he would not key his local repeater. This would require multi-frequency PL for base stations wishing to work more than their local repeaters.

Mobiles. When a mobile is near its local repeater it uses the local PL code. In other areas the mobile switches to the "universal" 100 Hz code. The mobile would need only a 2 freq PL board.

Portables. Portables would all use the "universal" 100 Hz tone since their low power would usually not key up more than the local repeater.

This plan would allow much closer spacing of repeaters than is possible with carrier or tone burst access, but the "universal" PL code would not shut out transient mobiles from repeaters outside their local area. It would work well for the less busy repeaters, though wide area, highly active systems would probably still need clear channels for some distance.

"Universal" tone squelch is worth considering as an alternative to 15 kHz channels.

Reprinted from Squelch Tale, *Chicago FM Club, Chicago IL.*

LETTERS

ANONYMITY ANSWERED

In reference to an anonymous letter printed in your September issue by a fellow seeking help in studying for his amateur radio license, I would like to offer a few points of interest. First off, I would like to offer my services personally to anyone who lives in my area (or wants to call me from Timbuktu if he likes) to give all the help they need to study for their exams.

I am Advanced class operator WB2TBC. My home phone is 427-7385; my work phone is 246-2310. I belong to the Hall of Science Amateur Radio Club in Flushing, New York (WB2JSM and WB2ZZO). The Hall of Science (as do many other clubs throughout the country) offers classes to hundreds of people every year in Novice, General, Advanced and Extra (both theory and code practice).

The club has programs whereby anyone who wants private instruction and help, in addition to the courses, can get someone from the club to work with him. I believe we have been very successful, having initiated nearly one thousand new hams in only three (3) years.

If the gentleman who wrote the anonymous letter will contact me,

Fred Kahn
305 E. 93 St.
New York NY 10028,

I will find a ham to help him — no matter what part of the country he lives in. I think (I know) there are many hams willing to help him; he just has not found them. By the way, I read your help wanted column every month and have offered my help to a few. Please print this letter so the gentleman who wrote the anonymous letter can see we really are a brotherhood.

Fred Kahn WB2TBC
New York NY

We are also happy to note the response of another Hall of Science'er, Bob Reiley WB2FHN, who wrote: "This is directed to the author of your item in the September, 1975 issue. If you live in the Metropolitan New York area, we are the ones you are looking for. Call Bob, 699-9400, days." What a club! — Ed.

I read in your September *73*, in the "Be My Guest" section, the letters from the two non-hams. I agree much with their statements of the plight of getting into ham radio. I am a ham, hold the Advanced class ticket, but haven't been able to be on the air much over the last four years.

I did not and do not have a technical background. When I first started in ham radio I thought a "plate" was something one ate off of and a "tube" was what toothpaste came from. I had little help with the theory . . . a good memory and the ability to "associate" and help with the code when I went for General was how I finally did get those tickets. I got in on the Advanced when it first came into being and still retained some of the theory from the other tests.

Although at this time I'm not actively on the air, I have helped a few, mostly kids, to get their Novice tickets on a 1:1 basis. I do not begin to understand all the theory, but by association, memory, and understanding what I could, I did get my tickets.

I live in an isolated section of the country now, but in December will be moving to Reno, Nevada. If anyone would like help by correspondence or lives in the Reno area, I will be more than glad to assist them in obtaining their Novice ticket.

M. K. Houston WA7LBQ
PO Box 177
Owyhee NV 89832

I sit here writing what is my second letter to a ham magazine ever. First I would like to thank you for printing my first letter in the August issue. I hope you can find room for this letter in an upcoming issue: I find myself needing to answer the comments made in the *Be My Guest* part of the magazine. I refer to the letter sent in by Glenn B. Knight and the one sent in anonymously. There are hams willing to help, I am forced to agree — not that many, but there are some. I, for one, want people to know that, if they are a non-ham and have a problem with finding help, that if they write to me and tell me the problem I will do my best to answer it or get one of the hams I know to do it. As long as they include an SASE.

I would also like to let people know the names of other hams willing to help, who have helped me: Eric Falkof K1NUN, Alan Burke W1RM, Irving Geller WA1CDW. I would like to draw special attention to Bill Sidell WA1HXQ, who took me in his ham shack and taught me how to work his receiver, allowed me to talk on his rig, and helped me learn code. Also Richard Metro W1NEX, who even now is helping to teach me how to build from scratch a transceiver and how to read schematics, so that I can understand theory better.

And last but not least, Bob Bello, President of the Middlesex Amateur Radio Club, who is helping the Ham Post 510 to obtain the knowledge it needs to help others earn their licenses. I think that it's radio operators like these who have the right to think of themselves as the elite group of hams.

Wayne S. Gateman WN1UXS
36 Madoc Street
Newton Centre MA 02159

TOP OF THE HEAP

Mr. Bob Brown
VHF Engineering
Binghamton, New York 13902

Friend Bob:

Yes, you are indeed a real friend even though I've only met you via the twisted pair. I want to compliment and thank you and the rest of the people at VHF for the outstanding way you have backed me up on the Repeater and Duplexer.

I know it's unusual for so many things: 1. Duplexer tuned backward. 2. One cavity with loose internals. 3. Receiver front-end and alignment problems. 4. Dud XMT crystal. 5. Ground loop troubles in the COR/Squelch circuits. 6. And finally,

shield cans acting as Diodes in the Transmitter.

WRØAFW is behaving beautifully and is drawing excellent reports — such as 50 miles with one watt — 15 mile HT-220 range, etc. — this with the antenna at only 80 feet. We are looking forward to the permanent site of some 200.

In my business, I deal with many broadcast supply companies and your performance in backing your products, by supplying all of the parts including a replacement Transmitter Strip so promptly, is certainly at the very top of the heap.

H. C. Snyder WØNVE
Fremont NE

YOU CAN'T MAKE THEM DRINK

Regarding *Be My Guest*, "How to Generate Your Own Interference", W2EUP, August, 1975:

Perhaps you would be interested in the experiences of our Radio Club, W3YXE, which followed the words of wisdom of W2EUP a year ago.

At that time a local CB club requested code and theory classes, estimating attendance of 50 people out of an approximate 500. We encouraged them to attend our annual classes which were about to begin. Our club offers complete help (besides code and theory), including repair of equipment, putting up antennas, etc. The first evening 8 people of the CB club attended. Drop-outs were high, with excuses of not being able to learn code, the XYL would not permit, weather was bad, etc. Not one completed the classes or was willing to try for the Novice exam. Their class was our one and only failure at gaining new operators. You are correct W2EUP, the CBers do want ham tickets, at least a few of them, but not enough to put forth the necessary effort. You can lead a horse to water but you can't make him drink.

Norma Vanderhoff WA3KKT
Corry PA

FINE BUSINESS

After an absence of quite a few years, I'm seriously considering getting back into ham radio. I'm not at all sure how I'm going to be able to operate a rig in a Manhattan tenement, surrounded on all sides by taller buildings, on a very low budget, but I hope to find a way.

I had a Technician class license, acquired in 1957. It appears that theory requirements are now more stringent than they were then, and I've forgotten nearly all the theory I ever knew!

Yesterday I picked up a copy of *73* in an electronics store — the first time I've seen the magazine. I must say, "Fine business!" I read the magazine from cover to cover — something I've never done with any magazine before! Many of the articles were above my level of technical understanding, but I learned something from all of them and, most important, they helped me to understand what kinds of questions I need to be asking. The entire staff seems to be doing an excellent job!

Paul Busby
ex-K5QJL, K9ZEM
New York NY

For your antenna problems, we suggest a look at our special antenna issue (March, 1975) and at "Antennas for Oscar — What Really Works?", July, 1975. — Ed.

REPEATER AND THE WOLF

We had a bit of excitement the other day on WR8ACG here in Akron. I thought you might get a kick out of it so I have enclosed a cassette tape for you to play. The incident is about a chap who had a stolen 2 meter FM rig and decided to use it on the repeater, feeling 100% he was on a CB channel.

It all started when one of the fellas on the repeater had his rig stolen from his car on Sunday morning, September 7th. That same night at about 10:10 pm an unfamiliar voice calling himself "Timberwolf" came on the repeater wanting to know if anyone had a copy on him.

The hams on the repeater at the time were aware of the theft and when they heard this fella, everyone dropped their call letters and started using assumed handles. The tape enclosed is only a small portion of the entire goings on, but is enough for you to get an idea of what went on.

"Timberwolf" was convinced that he was on a CB set and thought that the timer reset beep was someone running a Browning. He was so convinced that he was on CB that he gave one of our guys his phone number, and when he finally signed with his Timberwolf howl, Akron Police had already been contacted and were in the process of tracking down the phone number in their criss-cross. As it turned out, the number was unlisted so they had to wait till morning, when they contacted Ohio Bell for the info.

First thing Monday morning, Akron Police and detectives paid a visit to "Timberwolf's" house. Even though they had no warrant, "Timberwolf" let them inside. Akron Police then found the stolen radio, along with 10 pounds of marijuana and 3 other radios. They then returned to the station and then — armed with a search warrant — returned to "Timberwolf's" house to recover miscellaneous drugs, six firearms, stolen driver's licenses, stolen credit cards and a stolen tape player. "Timberwolf" was charged with several felony charges that day, and as a result of further investigation has ended up with the following charges against him:

Possession of Amphetamines
Possession of Heroin
Possession of LSD
Possession of Marijuana
Possession of Marijuana for sale
Possession of an Hallucinogen
Possession of Narcotics
Felon in possession of firearms
6 counts of receiving stolen property

So Wayne, needless to say, it appears that "Timberwolf" might be sent up the river for quite awhile. At any rate, his 10-4 good buddy days on the 04-64 Akron repeater are over for awhile.

Tom Weiss WA8VSY
Cuyahoga Falls OH

SLICING THE PIE

I was going over the August issue last night and reread Gilbert Boelke's "How to Generate Your Own Interference." He brings out many good points, to which I'd like to add a few.

I'd like to begin by saying that I almost went the CB route before I was convinced that the extra effort put out in obtaining a ham license would be worthwhile. I haven't regretted it yet.

While what I'm about to suggest may have been said before, I haven't yet heard or read of it. The animosity between hams and CBers can be done away with. As Mr. Boelke mentioned, CBers are a potential source of new

blood for us. I'm sure that many of them were at the same crossroads as I was six years ago, and for various reasons chose CB over ham radio.

What can we do? Well, first we can talk it up at a club meeting. It's not a forbidden topic, as some may think. From there the club could contact a local CB organization and arrange to send a small delegation to one of their meetings to give them a rundown on what ham radio is really about. Follow up with an invitation for a few of the CBers to give their side of the story at a ham meeting. Not only may you learn something, but it saves the program chairman from the agony of having to come up with something new and interesting when none of the members volunteer. If you really want to build on this, why not check into the possibility of a joint meeting. It never hurt anybody to meet the other guy half way, and understanding the other guy a little better never did any harm. They're people just like you and me – responsive to somebody else who moves to know them just a little better. We all know that we can always learn something from the other guy. (When you heard your first SB-104, didn't you chew the other guy's ear off with questions about it?)

Maybe getting ahead of myself, but certainly not being unreasonable, is the possibility of getting the CBers into public service. Invite one of the local REACT groups to help provide communications for a parade, walkathon, etc. Cooperation and coordination such as this could prove invaluable should disaster strike. Think about it. We may be giving up a slice of the public service "pie," but then everybody stands to benefit. When you come down to it, isn't that what it's all about?

Think about it. Talk about it. Above all, give it a try. There's nothing to lose, everything to gain, and it won't hurt a bit.

Scott Liebling WA3OXG
Pittsburgh PA

XU4XA

Enclosed is a copy of a letter from W6CLB, ex-XU4XA, a result of your publication of my article, "Odd Problems with an Old Antenna", which appeared in the September, 1975 issue of *73*.

OM Lower's letter brought back a flood of memories to me, and I feel sure it will do the same to many who read it.

You undoubtedly know that all those calls mentioned in my article were for real – at that time. It has always bugged me that *QST* has carried very little about the war-time and later activity of the people who operated those DX stations. I had to go to the library to find out what happened to Reg Fox (AC4YN) after he had to flee Tibet!

Byron H. Kretzman W2JTP
Huntington NY

Dear OM,

Read your article on page 100 of the September issue of *73 Magazine*, and was quite pleased with it – especially since you mentioned one of my old China calls – XU4XA!!

I guess we must have been QSO with that call at one time – I don't know. That was a station I had in the American Embassy in Chungking, which was up the Yangtze River about 1500 miles in West China (Szechuan Province).

I lived in various parts of the Far East with the US Navy from 1930 to 1940. I had ham stations in Shanghai, Tsingtao in North China, and the XU4XA in Chungking. Also used to work from Hong Kong using a rig that belonged to a British Navy man – VS6AQ. In the Philippines I used to work from KA1BH and KA1CM.

I think I have worked old W8CRA from just about every place I ever ran a ham rig out there – he sure had a signal and knew how to dig out the DX! Wonder if he is still alive and kicking?

I went from Shanghai to Chungking in 1938 and the Chinese and Japanese were having one of their wars. I built a transmitter in Shanghai, scrounged an HRO receiver, had a Japanese friend make me a big auto-transformer (on account of the line voltage fluctuations in the interior cities of China) and packed up my ham rig (which had an 803 in the final). My receiver was an RME-69 with a preselector. I gathered up what spare parts I could, packed it all up and went to Hong Kong on an old Navy coastal gunboat.

In Hong Kong, I got passage on what proved to be the last train to run from there to Hankow. It was usually about a 24 hour run, but this time it took us about five days, because the Japanese were bombing the railway and we had to hide and wait until the Chinese repaired the tracks so we could proceed – that was some ride!

When we got to Hankow, the Japanese were bombing the railway station, so we made a dash for the Yangtze River and managed to get the attention of the flagship of the US Navy Yangtze patrol about a mile across the river. They sent a boat for us, and we figured that our radio gear was gone in the bombing of the railway station. It was all smoking and on fire, but when we went back early the next morning, the baggage car that contained our stuff was OK, so we hired a few coolies and carried it down to the river and then across to the USS Luzon.

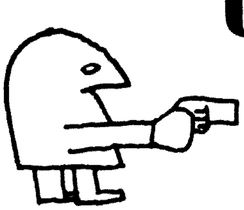
The Japanese were on the verge of taking Hankow (lots of bombing of the city and fires), and the Chinese government decided to move out to Chungking. The American Embassy staff was there, including the ambassador, and I was attached to his crew to set up and operate a radio station for him so he could keep in touch with the flagship of the Asiatic fleet and move his traffic. Anyway, we left that afternoon and ran up the Yangtze. We had to go through the Yangtze Gorges to get to Chungking. I think it was about 400 or so miles, a very interesting ride with spectacular scenery; we could only run during daylight, since it was too dangerous at night.

Another smaller Yangtze River patrol gunboat, the USS Tutuilla, went with us. She was to remain in Chungking as station ship. We carried all the embassy staff on the two gunboats. When we finally reached Chungking, we went ashore and set up our radio station in the top floor of the old Standard Oil Company Building, which was to be the American Embassy.

There were three of us Navy operators assigned to detached duty with the embassy. I had to do all the maintenance, as well as operate – the other two guys were mainly operators. The three of us maintained a continuous 7 day weekly watch and we handled two or three hundred messages each way every day – a lot of them three and four page encoded messages, so you can see we kept busy! When there were air raids (of which we had over 400 in two years), the local power went off and we had to hightail it down the hill and set up a watch on the gunboat there until the all clear sounded (but they were down on the river and conditions were pretty poor – we were up the side of the river bank a way and it was better). Incidentally, we maintained a

Continued on page 26

CONTESTS



Editor:
Robert Baker WA1SCX
34 White Pine Drive
Littleton MA 01460

1976 SUMMER OLYMPICS AWARD

A certificate to honor the 1976 Summer Olympics will be awarded by the Westminster Amateur Radio School to licensed amateurs who comply with the following requirements:

1. Canadian amateurs must work 10 Montreal *Island* stations. (Montreal Island stations must work 20 Montreal Island stations.) VHF/UHF repeater contacts disallowed.
2. Foreign amateurs must work 5 Montreal *Island* stations.
3. Contacts must be made between August 1, 1975 and July 31, 1976, and contacts may be made on any mode.
4. Send $1.00 or 5 IRCs, and a copy of your log containing: date, time, station worked and operator, mode, frequency, received signal report, and sent signal report. NO QSLs ARE REQUIRED !!!!!!

Send applications to:

Secretary
Westminster Amateur Radio School
Box 323
Montreal Int'l Airport, A.M.F.
P.O., Canada

RSGB 7 MHZ DX CONTEST PHONE

Starts: 1800 GMT Saturday, November 1
Ends: 1800 GMT Sunday, November 2

EXCHANGE:

Report and serial number, starting with 001.

SCORING:

Non-British Isles stations score 5 points for each contact with the British Isles; those outside Europe score 50 points. All may claim a bonus of 20 points for each British Isles numerical prefix worked (G, GC, GD, GI, GM, GW – 2, 3, 4, 5, 6). Contacts with stations using GB prefixes will not count for bonus points.

AWARDS:

Non-European stations must make at least 10 QSOs to qualify for an award.

LOGS:

Logs and entries must be addressed to the HF Contests Committee, c/o J. Bazley G3HCT, Brooklands, Ullenhall, Solihull, West Midlands, England, to arrive no later than December 29th.

EUROPEAN DX CONTEST RTTY

Starts: 0000 GMT Saturday, November 8
Ends: 2400 GMT Sunday, November 9

Rules for the contest are the same as for the Phone section, with one exception:

In the RTTY section, contacts with one's own continent are permitted and count 1 point per QSO. Multipliers will be counted as before.

Complete rules appeared in the September issue on pages 14 and 15. Briefly, the basic rules are as follows:

Use all bands 3.5 through 28 MHz, with only 36 hours of operation out of the 48 hour contest period for single operator stations. The 12 hour rest period may be taken in up to 3 periods. Classes include single operator (all band), and multi-operator with single transmitter.

EXCHANGE:

RST and progressive QSO number starting with ØØ1.

SCORING:

Each QSO will count 1 point. A station may be worked once per band. Each QTC (given or received) counts 1 point – see September issue. The multiplier for non-European stations is the number of European countries worked on each band. Europeans will use the ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, UA9/UAØ. The multiplier on 3.5 MHz may be multiplied by 4; the multiplier on 7 MHz may be multiplied by 3; the multiplier on 14/21/28 MHz may be multiplied by 2. The final score is the total QSO points plus QTC points, multiplied by the sum total multipliers from all bands.

AWARDS:

Certificates to highest scorer in each country, reasonable score provided. Continental leaders will be honored. Certificates will also be given to stations with at least half the score of the continental leader.

LOGS:

Use a separate log sheet for each band. Logs for the RTTY section should be mailed no later than December 1st. North American stations may send their contest logs to: H. E. Weiss WA3KWD, 762 Cheuch St., Millersburg PA 17061, USA. All others should send their logs to: WAEDC – Committee, D-895 Kaufbeuren, Postbox 262, Germany.

ARRL SWEEPSTAKES CW

Starts: 2100 GMT Saturday, November 8
Ends: 0300 GMT Sunday, November 10

Phone

Starts: 2100 GMT Saturday, November 22
Ends: 0300 GMT Sunday, November 24

Sweepstakes is sponsored by the ARRL and is open to all amateurs in the US, US possessions, and Canada. No more than 24 hours of operation are permitted during the 30 hour contest period. Time spent listening counts as operating time and OFF periods may not be less than 15 minutes. Times on and off as well as QSO times must be entered in the log. Each station may be worked only once, regardless of band.

CLASSES:

All entries will be classified as either single or multiple operator stations. Single operator stations will be further classified by input power; Class A = 200 Watts dc or less, Class B for above 200 Watts. All ARRL affiliated clubs may also participate in the club competition.

EXCHANGE:

Number, precedence, your call, CK and ARRL section. Send A for precedence if power is 200 Watts dc or less; otherwise send B. For CK, send the last 2 digits of the year you were first licensed.

SCORING:

Score 2 points for each completed QSO. Final score is sum of QSO points multiplied by the total number of ARRL sections plus VE8 (max. 75).

AWARDS:

Certificates will be awarded to the highest scoring class A entry and the highest scoring class B entry in each section, provided there are at least 3 single operator entries or the score is

10,000 points or more. Certificates will also be awarded for high scoring Novices and Technicians. Multi-operator entries are not eligible for certificate awards and will be listed separately in the results.

FORMS:

It is suggested that contest forms be obtained from ARRL, 225 Main St., Newington CT 06111. All entries with 200 or more QSOs must have a cross-check sheet to check for duplicate QSOs. Each log must show date, QSO time, times on/off, exchanges sent and received, band and mode.

These rules were taken from last year's contest. For complete rules, see the October issue of QST.

MISSOURI QSO PARTY
Starts: 1800 GMT Saturday, November 15
Ends: 2300 GMT Sunday, November 16

The St. Louis Amateur Radio Club will sponsor the 12th Annual Party with an effort to activate some of the hard-to-get Missouri counties. The same station may be worked once on each band/mode. Missouri mobiles will count separate from each different county.

EXCHANGE:

QSO Number, RS(T), and QTH – county for Missouri stations, state, province or country for others. Missouri mobiles will start with number 1 from each county activated. Frequencies on most bands will be 60 to 70 kHz up from the low end of the band.

SCORING:

One point per QSO. Missouri use states, provinces, and countries for multiplier; others use Missouri counties (maximum 115). Missouri mobiles total separate score from each county activated.

AWARDS:

Certificates to top scores in each state, province, and country, top ten Missouri entries, and top three Missouri mobiles.

MAILING DEADLINE:

December 15th, to The St. Louis Amateur Radio Club, KØLIR, 842 Tuxedo Blvd., Webster Groves MO 63119. Include an SASE for a copy of the results.

CQ WW DX CONTEST – CW
Starts: 0000 GMT Saturday, November 29
Ends: 2400 GMT Sunday, November 30

The contest is open to all amateurs and all bands. 160 to 10 meters may be used. Stations are permitted to contact their own country and zone for multiplier credit. The *CQ* Zone map, DXCC and WAE country lists, and WAC boundaries are standards.

CLASSES:

Single Operator – single or all band; Multi-Operator – single or multi-transmitter (all band only). Also, club competition.

EXCHANGE:

RST and Zone.

SCORING:

Contacts between stations on different continents count 3 points. Contacts between stations on the same continent but different countries count 1 point. For North America stations only, contacts between stations within NA count 2 points. Contacts between stations in the same country are permitted for multipliers but do not count for QSO points. The multiplier is the total number of different zones and countries worked on each band. Final score is the sum of QSO points times the total multiplier.

AWARDS:

First place certificates will be awarded in each class in every participating country and in each call area of the US, Canada, Australia, and Asiatic USSR. Final results will be published in *CQ*. To be eligible for an award a single operator station must show a minimum of 12 hours of operation. Multi-operator stations must operate a minimum of 24 hours. A single band log is eligible for a single band award only. Second and third places will be awarded if warranted. There is also a long list of trophies that will be awarded.

LOGS:

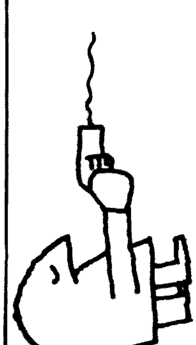
All times in GMT. Indicate zone and country multipliers only the first time worked on each band. Check for duplicate QSOs and correct QSO points and multipliers. Use a separate log sheet for each band. For official logs, summary sheet, and zone maps, send a large SASE to: *CQ* WW Contest Committee, 14 Vanderventer Ave., Port Washington, L.I. NY 11050. Logs should be postmarked no later than one month after the contest and should be sent to the address above. Indicate phone or CW on the envelope.

These rules were taken from last year's contest. Check the September issue of CQ *for complete rules.*

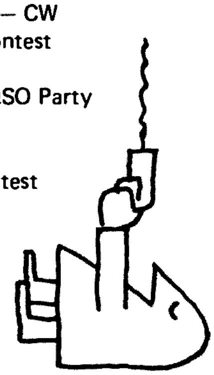
ARRL 160 METER CONTEST
Starts: 2200 GMT Friday, December 5
Ends: 1600 GMT Sunday, December 7

Continued on page 23

CONTEST CALENDAR

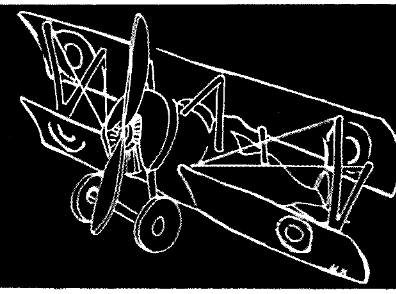


Nov 1 - 2	RSGB 7 MHz DX Contest
Nov 1 - 2	Worked All El Paso Contest
Nov 1 - 3	North Carolina QSO Party*
Nov 6 - 7	YL Anniversary Party – PHONE*
Nov 7 - 8	Trillium Weekend Contest (TOT)
Nov 7 - 10	IARS/CHC/FHC/SWL-CHC/HTH QSO Party*
Nov 8 - 9	European RTTY DX Contest
Nov 8 - 10	ARRL Sweepstakes – CW
Nov 9	International OK DX Contest*
Nov 15 - 16	Missouri QSO Party
Nov 15 - 16	All Austria Contest
Nov 22 - 24	ARRL Sweepstakes – PHONE
Nov 29 - 30	CQ WW DX Contest – CW
Dec 5 - 7	ARRL 160 Meter Contest
Dec 6 - 7	Delaware QSO Party
Dec 6 - 7	Telephone Pioneer QSO Party
Dec 6 - 7	TOPS CW Contest
Dec 7	TU2 Competition
Dec 13 - 14	ARRL 10 Meter Contest
Dec 13 - 14	EA Contest – CW
Dec 28	HA5 – WW Contest
Dec 31	Straight Key Night
Apr 3 - 4	Florida QSO Party



* = described in previous issue.

Autobiography of an Ancient Aviator



W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230

Two Lucky Ones

Doyle had plans to start working our way south from Elkins, West Virginia about the middle of October, with his "Flying Circus". On Saturday, October 6, the local high school football team was entertaining its biggest rival, and they asked us to fly over the field and drop a football to start the game. Dice Harper, who owned the field we were operating from, volunteered to go along and toss out the ball. All went well as I throttled back and came in low over the football field. Harper dropped the football on the button but when I gave the engine the gun to climb out of there it picked that moment to "pack up". I only had enough flying speed to allow me to turn and get over some high tension wires into a very small field with woods at its end. Not even enough room for a ground loop before hitting the trees. So I aimed our nose right in between the two largest trees, took off my goggles, and ducked. Dice Harper and I escaped with only a few superficial scratches, but the R4 was totaled except for the undependable engine.

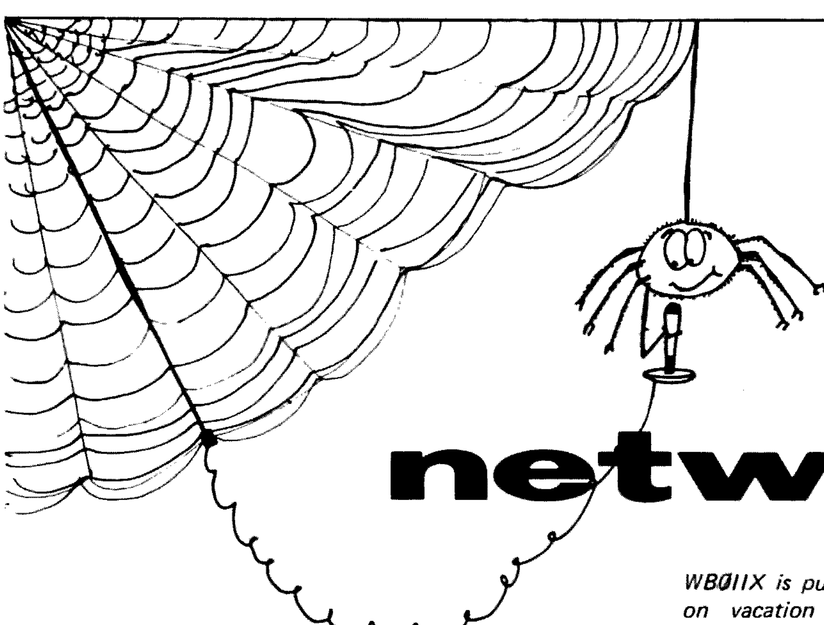
So I aimed our nose between the two largest trees, took off my goggles, and ducked.

My pay automatically stopped when the R4 did, so I came back to Brooklyn. When I got there I found a letter from the Mitchel Field operations officer saying that they were putting on a carnival from November 6th to 10th and asking me if I would lead a formation of five jennies piloted by reserve officers. I phoned him at once and gave him a list of the reserve pilots I thought might be best for close formation work. We had two weekends to practice together, and so were able to put on a pretty good show.

That ended my flying for 1923. I got a lot of experience that was to be a great deal of help in later years. Then back to the Van Alstyne Huppmobile Company and the beautiful new 1924 Hupps.

Just after the first of 1924, Gillespie of Federal Aviation Co. in Newark phoned me to say he had sold another LWF and that the owner wanted a pilot to fly the ship on a few advertising missions over Newark. He was willing to pay $30 a flight, so I took the LWF out of Heller Field and based it at Hasbrouck Heights (now Teterboro Airport). The missions turned out to call for flying very low over Broad Street, Newark, with my passenger throwing out a large load of advertising leaflets. I flew ten of these missions, changing landing fields several times, before the police caught up with the plane's owner. Fortunately, I was not around when the axe fell.

The next call from Gillespie came around the first of July. He had sold an LWF to a David Morris of Youngstown, Ohio, who wanted a pilot to fly passengers from a field he had rented near Amityville, Long Island. By that time my price for taking an LWF out of Heller Field had gone up to $50. My log book says that I took the ship out of Heller on July 1st, picked up gas and Morris at Hasbrouck Heights, and flew him to his field at Amityville. From then to



E. H. Barnett WBØIIX
Route 1
Ashland, Missouri 65010

You can only get out of amateur radio what you are willing to give. Check into a net. You will make new friends who will be there when you need them! (Ever tried to raise a tower by yourself??) If you don't want to wait for a long roll call, most nets have a "Short Timer's" check-in before roll call. If you do check into a net, tell me about it so I can include it here.

networks

WBØIIX is purported to be checking out nets while on vacation in Yellowstone National Park. His column will return next month. — Ed.

August 20th I put in forty odd hours hopping passengers on weekends and evenings.

I have no recollection of many of the hundreds of people I carried during those two months. Morris just collected $5 a head and loaded them into the front cockpit four at a time, and I gave them a ten minute ride around the field. There was one rider, however, whom I won't forget. We were about to fold the operation late one afternoon when Morris put a lone passenger aboard. This fellow quite obviously had more than "one over the eight" but he seemed docile enough. Anyway, we were no sooner airborne than he unbuckled his seat belt, stood up in the cockpit, and proceeded to relieve himself. I was piloting from the rear cockpit so the type of shower I was getting was most unwelcome. I maneuvered the ship every way I could think of to make the force of gravity work in my favor. Believe me, he got a real fast roller coaster ride around the field.

On the afternoon of August 20, when I arrived at our Amityville field, Morris told me he wanted to get some repair parts at Curtiss Field, so we flew over to get them. Arthur Berry, another Van Alstyne salesman, was with us. Just as we were starting back Morris suggested that we climb to 2000 feet and do a turn or two or a spin before landing. I had spun the ship many times before so I agreed. When we neared our field I put the ship into a shallow tail spin. Just then the good old unreliable Hisso conked out. Well, that didn't worry me until I tried to get the ship out of the spin. Evidently the tail surfaces were not large enough to do the job without power. I couldn't even rock the ship out of it. So we rode it in.

I flew ten of these missions, changing landing fields several times, before the police caught up with the plane's owner.

We hit in a field in Meridale Park, Lindenhurst. I certainly didn't pick the place but "some one up there" sure did. All three of us were knocked out and a fire started around the engine. It just so happened that the Lindenhurst Fire Department's two running teams, the Liberty Hose and Union Hook and Ladder, were practicing in the field for the annual tournament of the Suffolk County Volunteer Firemen's Association at Bay Shore the next week. They put the fire out quickly, pulled all three of us from the wreckage, and rushed us, with sirens at full blast, to Dr. Reid's Private Hospital in Amityville. It was only eight minutes from the time we hit until we were being treated by Dr. Reid. Try to beat that one. Dave Morris died that evening. Art Berry escaped with a broken jaw and leg and various contusions. I had some broken ribs and a few cuts and bruises.

In spite of strapped ribs I was able to report for two weeks active duty at Mitchel Field on September 3rd. I put in some twenty odd hours of flying time during this tour with no further incidents.

Next month: Military flying, circa 1925.

Oscar 6 Orbital Information				Oscar 7 Orbital Information				
Orbit	Date (Nov)	Time (GMT)	Longitude of Eq. Crossing °W	Mode	Orbit	Date (Nov)	Time (GMT)	Longitude of Eq. Crossing °W
13917	1	01:29:20	73.3	A	4389	1	00:34:36	58.5
13929	2	00:29:16	58.3	B	4402	2	01:28:53	72.1
13942	3	01:24:12	72.0	A	4414	3	00:28:14	56.9
13954	4	00:24:08	57.0	B	4427	4	01:22:31	70.5
13967	5	01:19:04	70.8	AX	4439	5	00:21:51	55.3
13979	6	00:19:00	55.7	B	4452	6	01:16:08	68.9
13992	7	01:13:56	69.5	A	4464	7	00:15:29	53.7
14004	8	00:13:52	54.5	B	4477	8	01:09:46	67.3
14017	9	01:08:47	68.2	A	4489	9	00:09:06	52.1
14029	10	00:08:44	53.2	B	4502	10	01:03:23	65.7
14042	11	01:03:39	66.9	A	4514	11	00:02:44	50.5
14054	12	00:03:35	51.9	BX	4527	12	00:57:01	64.1
14067	13	00:58:31	65.7	A	4540	13	01:51:18	77.7
14080	14	01:53:27	79.4	B	4552	14	00:50:38	62.5
14092	15	00:53:23	64.4	A	4565	15	01:44:55	76.1
14105	16	01:48:19	78.1	B	4577	16	00:44:16	60.9
14117	17	00:48:15	63.1	A	4590	17	01:38:33	74.5
14130	18	01:43:11	76.8	B	4602	18	00:37:53	59.3
14142	19	00:43:07	61.8	AX	4615	19	01:32:10	72.9
14155	20	01:38:02	75.6	B	4627	20	00:31:31	57.7
14167	21	00:37:59	60.6	A	4640	21	01:25:48	71.3
14180	22	01:32:54	74.3	B	4652	22	00:25:08	56.1
14192	23	00:32:50	59.3	A	4665	23	01:19:25	69.7
14205	24	01:27:46	73.0	B	4677	24	00:18:46	54.5
14217	25	00:27:42	58.0	A	4690	25	01:13:03	68.1
14230	26	01:22:38	71.7	BX	4702	26	00:12:23	52.9
14242	27	00:22:34	56.7	A	4715	27	01:06:40	66.5
14255	28	01:17:30	70.5	B	4727	28	00:06:01	51.3
14267	29	00:17:26	55.5	A	4740	29	01:00:18	64.9
14280	30	01:12:22	69.2	B	4753	30	01:54:35	78.5

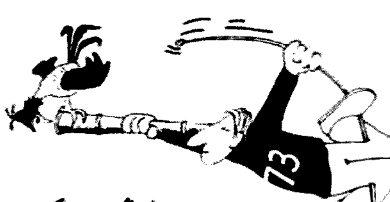
amsat

Use of ASCII Approved for Amateur Satellites

The FCC has issued a Special Temporary Authority (STA) to the Radio Amateur Satellite Corporation (AMSAT) allowing the use of ASCII by radio amateurs through the communications packages aboard the OSCAR 6 and OSCAR 7 satellites. The STA has been granted until 28 February 1976. At the conclusion of this period, AMSAT will compile a report of the results of the experiments conducted and callsigns of the amateurs involved. More information can be obtained from AMSAT, Box 27, Washington DC 20044, phone (202) 488-8649.

Gary L. Tater W3HUC
7925 Nottingham Way
Ellicott City MD 21043

TM



Looking West

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

ALL QUIET ON THE WESTERN FRONT

My goodness. I get the feeling I may have created a monster, though a good "monster" in the eyes of the amateur radio community. A few months ago, we suggested in this column that amateurs as individuals and collectively take on the task of educating the general public as to who we were and what we could do. It was suggested at that time, and still is, to make use of what the mass communications media calls the Public Service Announcement, or simply PSA (not to be confused with the airline of the same initials). The reason that I personally favor the PSA over other methods of reaching the public at large is that it has the possibility of reaching them at the most opportune moment – the time when they are relaxed and enjoying a program on the "one-eyed monster". Can you imagine the numbers of amateurs that might come to our ranks if such an announcement was run in the middle of a well promoted network movie or, even better, in the middle of the Johnny Carson Tonight Show?

I would be willing to "bet my sweet bippie" that such a sales campaign for amateur radio would do more to stimulate interest in our hobby than 20282 or anything else in the way of restructuring. Sure, restructuring in some form is necessary; most of us agree on this point. However, who outside the amateur community itself will ever hear about it? I doubt if the *New York Times* is going to run a headline "Amateur Restructuring Passes" on the day when the Commission releases its Report and Order on the subject. Heck, I doubt if even the *L.A. Free Press* or *Village Voice* will give it a mention. Simply, the media won't know – much less care. Except to the amateur community itself, what goes on within our ranks is rarely deemed newsworthy.

As a viable and worthwhile minority community within the structure of international society, we have a right to public recognition of our achievements and to the respect that is accorded all other minority communities. While many other minority groups are held together along ethnic or socio-economic lines, our bond comes from our mutual interest in interrelation with one another through the use of radio. The very nature of our ability to communicate on an international basis, freely and openly, does indeed make us a sub-culture of international proportion. As such, we can no longer permit the public to look upon us as "tinkerers" or "electronic freaks".

The image of the "hermit" hidden away in the attic, surrounded by racks of equipment, tons of wire and the like must be laid to rest for eternity. We must draw the dividing line between amateur radio and citizen's band radio – doing so in a way that is in no way derogatory to either. However, it must be made clear that there is a difference between the two services, and this must be made crystal clear to the media and the public. I for one am tired of hearing and reading news articles in which the amateur community is confused with the citizen's radio service, and I suspect that they too feel the same way when they are confused with us.

The key to this is obvious: education through the media, through the public school systems, and through fraternal organizations. Recently I had the opportunity – no, honor – of speaking to a group of "young people" who were busy working toward their amateur licenses under the guidance of Mr. Ted Ryan WB6JQX. Ted is a teacher at John Burrows Junior High School in Los Angeles, and during the summer session runs a class geared toward helping those young people who are interested to obtain their amateur license. Ted had asked if I could drop by and explain a bit about VHF and repeaters to his two classes. So, armed with a Bell and Howell Super 8 Sound Projector, one of the PARC films, and a loving wife for support, we made the 25 minute trek down the Hollywood Freeway.

What met me was a surprise that I will always remember. There in the Electrical Shop bungalow were gathered a true cross-section of our nation's future! Young people aged 10 to 14 were there, male and female, representing almost every nationality and ethnic background, all intent on one goal: becoming members of the sub-culture we call amateur radio. No one had forced these "little people" to spend their vacation in school; they were doing so because they wanted to, because getting their amateur ticket was important to them – and to their future.

There was a feeling of mutual love between Ted and his class that you could actually feel, though you could never adequately describe it in words. Here, in Ted, I saw a thing of beauty. Here was a man with a love of amateur radio and the ability to share this love, and the knowledge contained therein, with those who are truly the future of this nation and maybe the world: the children, the "little people" who were on their way toward becoming the "big people". In my eyes, they're better than half way there! As I said, education in all its forms and via every avenue available is the key to our survival and prosperity. We must all work together so that we will not fall together.

As an initial step in developing dialogue between the amateur radio community and the mass media, ARRL Southwestern Director John Griggs W6KW has appointed Lenore Kingston Jensen W6NAZ as liaison between the broadcast media and the amateur radio service.

Her job and that of her committee will be twofold: First, to educate the media as to what the amateur service is, provide technical assistance at times when amateur radio is being dealt with by the broadcast media, and generally make sure we are treated in a favorable light. And second, the other facet of this committee's work will be to work toward getting specific "PR" via the media for amateur radio. This might include producing news documentaries and the like dealing with us, as well as providing interested groups with speakers well versed in the many diverse aspects of our hobby. In having Lenore in this position, you have probably one of the most qualified people possible taking on this task. She is a person well versed in the subject, having been involved within the broadcast media for many years, and a person respected with much admiration in both the media and amateur radio.

She has both the experience and talent necessary and not only do I wish her "good luck", but also my personal support and that of this column. There is a long road ahead, but the seeds of the future have now been planted and are starting to take root. If you have any suggestions as to how this formidable task can be accomplished, or if you are involved in any phase of the broadcast media (anyplace in the nation) and feel you can be of help on this project, either contact Lenore W6NAZ or yours truly and I will forward your letters to Lenore. The leadership is now here; the ideas and help must come from you!

Bill Orenstein KH6IAF and myself are both what Jean Shepherd K2ORS terms "night people". (How I miss Jean's radio show out here, since KPFK decided to no longer carry it last year!) That is to say, Bill and I tend to function much better after the sun goes down. So it was the other evening when we collectively wrote the following on SAROC Hawaii. As I said last month, though a native Angelino, Bill is a transplant to the Hawaiian Islands, returned to LA for business reasons. Therefore, whenever a reasonable excuse arises, Bill is not against spending five hours aboard a 747 so that he can spend a few weeks in his adopted home state: Hawaii. SAROC Hawaii was just such a happening.

Bill had but one major complaint about the convention, in that everything — speakers and exhibitors — was in one room, with no form of partition in between. In his estimation, this made it more than a bit difficult to direct one's concentration toward either. (Leonard Norman, take note for next time.) Even a simple folding partition to separate the two would have done wonders to eliminate the confusion.

Turnout was lighter than expected and Bill estimates that about 250 would be a fairly accurate figure, with about 70 to 80 coming from the mainland. This was far below expectations. Perhaps a less expensive travel package on the part of Del Webb Enterprises, the promoters of SAROC Hawaii, would be something to consider for such events in the future. Hawaii is not exactly around the corner for most mainlanders and, with the economy in its present state, most people think twice before shelling out a bundle for airline and hotel reservations. Putting a travel package for such an event within the price range of the average ham could do wonders for attendance.

The highlight of the convention was a talk given by Mr. Charles Higginbotham of the FCC concerning restructuring, in which Mr. Higginbotham was not only very open and candid about the whole subject, but quite willing to field any questions put before him. Bill got the feeling that Mr. Higginbotham was quite sincere in his feelings toward amateur radio and that he is a person to be looked to for support for our service. Bill taped this talk and I hope to be able to transcribe it and bring it to you in the near future; I for one was impressed with what I heard.

As you may have noted during the past few months, I have been quite hard on those we call "jammers". "Malicious malcontents," I term them: people with warped minds who have no place in amateur radio or on our bands . . . licensed or otherwise. I feel that the best way to stop the jamming of our VHF Repeaters and HF Nets is to publicly expose those who would do us dirt, and shame them in front of their peers as well as the rest of society. The longer we wait, the worse the situation will get, unless some form of strong leadership arises in that direction. If one would-be num-num sees person "A" getting away with it, then chances are that num-num "B" will join in to get his share of the kicks.

The problems being incurred by WCARS are well known, and for that very reason they started collecting donations for what is termed the

Continued on page 21

WANTED

FOR JAMMING

ANY MISGUIDED RADIO OPERATOR,

ON ANY HAMBAND!

REWARD

$100.00

FOR INFORMATION LEADING TO LICENSE SUSPENSION, REVOCATION, OR CRIMINAL CONVICTION.

CONTACT ED PECK, ATTY., 405 14TH ST., SUITE 800, OAKLAND, CA. 94612

This offer is a legitimate one from friends of WCARS.

... de W2NSD/1

from page 2

about I only have to look at a couple of the nearby repeater groups and project the situation. Let's take the Boston 19-79 repeater as a horrible example.

The New England coordinators have coordinated this pair to a repeater at the Crotched Mountain Rehabilitation Center in Francestown NH. There are a number of crippled children there with ham tickets who would like to operate with small rigs from their wheelchairs and be able to communicate with people outside. A 90 foot tower and a complete repeater have been donated to the Center. The tower is up, but the repeater has not been put on the air because no local amateur has been found with enough time to help in the installation of the repeater.

A Boston amateur, who had not made himself popular by deciding that his hobby was DXing on repeaters, complete with a powerful base station and beam (aided by a Clegg 27B which put him on every channel he wanted to DX), got the idea to put up his own repeater. Other repeater owners breathed a sigh of relief.

To hell with the crippled children and their channel — Boston soon had a powerful 19-79 autopatch repeater, complete with day and night dialing up of weather, time and every other phone company service. Despite the discouragement of anything but phoning on the repeater, a small collection of groupies collected and spelled the owner in this work.

Then came a bright idea — how about a 34-94 repeater in Boston to give out Bicentennial information? Fantastic — and to hell with the frequency coordinators who were still trying to get that 19-79 machine off the air. And to hell, too, with the Concord NH repeater on the channel about 70 miles away, even though it could be used easily all through the area by most mobiles.

A great many of the ops using the new 34-94 Boston machine also came in just fine on the NH repeater, causing some hard feelings. Despite severe criticism and every effort of the frequency coordinators, the new repeater has remained on.

With two pirate repeaters going, why not more? The next choice was 13-73. This pair had been tried in Boston in the past, but interference with nearby Maine, Cape Cod, Rhode Island and Western Massachusetts 73 repeaters had been too severe and the pair had been abandoned in Boston. The channel was essentially in full use by another Boston group on 145-745, just 15 kHz off the 13-73 channel. A 13-73 repeater would clobber them. So they quickly bought new crystals and moved to the 13-73 pair to hold the channel. The interference to the other four repeaters, all about 75 miles or so away, was as predicted.

Once the plans for a new 13-73 machine were positively scrapped, the 145 group moved their repeater back where it had been and everything quieted down. But not for long. DL2AA/WR1, the first reciprocally licensed repeater in the country, on 81-21, decided to quit (very, very little activity). The 19-79 chap grabbed it and added that to his growing collection of repeaters. The uproar over this further ignoring of the coordinators has been

Every FMer should make it his own personal business to resist uncoordinated repeaters . . .

considerable. The old 81-21 location was low and plans had been well along for a repeater on that channel in Western NH, but this would not work with the newly located 81 site.

And so it goes. This same story, with other channels and other casts of characters, is being replayed all over the country. This will continue as long as FMers don't insist on repeater owners being coordinated. Every FMer should make it his own personal business to resist uncoordinated repeaters in every way he can. He should refuse to use these pirates for contacts, he should take every opportunity to tell the owner how he feels about this pirate action, and he should try in every way to convince the people using the pirate repeaters to stop encouraging the setup.

Keep it legal. No kerchunking, no bad language . . . just call in, state your message, sign your call, and ask other users to join you on a coordinated repeater to discuss the situation. Try not to get into arguments on the pirate repeater — make them go to a coordinated repeater for discussions. The future of FM and repeaters lies in your hands. Are they to be an instrument of ego for a few or a service for all of us?

TENNESSEE DEVELOPMENT

The Eddy Palmer K4LSP situation has changed a bit. Encouraged by a few local amateurs, the Kingsport repeater has been causing serious troubles to the Mt. Pisgah repeater. The latest word is that the FCC has stepped into the picture (and this is what many of us had hoped would not have to happen). Eddy has been accused of deliberate and malicious interference to the Mt. Pisgah repeater . . . and the tapes I've heard leave little doubt about this accusation. It is reported that Eddy, a Conditional licensee, has been recalled for a new exam by the FCC and that both repeaters may be moved to separate splinter channels to stop the jamming. Since there appear to be several quite acceptable standard channels available for the Kingsport repeater, it is expected that it will be moved to one of them instead of to a splinter, thus leaving Mt. Pisgah on the 16-76 pair.

One factor that had bad consequences in this case was that in some way Palmer managed to be accepted as the frequency coordinator for Tennessee! Somebody goofed. The whole situation would take a book to cover thoroughly — and the file on it is a thick one here at *73* — if you have a few hours you are welcome to go over it and listen to the hours of tapes of the jamming. However, once the repeater council acted and demanded that Palmer move his repeater, the onus of further developments was on those amateurs who refused to force Palmer to follow through. Those who continued to use the Kinsport repeater backed up Palmer in his flaunting of the council. Here is where individual responsibility lies. These amateurs knew about the council action, yet they behaved contrary to it.

We can keep amateur radio a top notch hobby if we really do use peer pressure to keep it clean. But when we go along with things we know are not right we are no better than the worst of the CBers.

With the seemingly inevitable influx of CBers through the coming Communicator ticket, we'd better shape up. These chaps will conform to whatever mode of operation they find when they join us. If we continue to flaunt our own self-imposed rules about frequency coordination, they will compound the problem for us. If we keep bringing out the worst in ourselves over the air — discouraging interesting contacts — encouraging long winded boring ops — encouraging

old timers who repeat everything they say at least five times – we will suffer the consequences.

Proposal: Since it is almost impossible to get on the air on a repeater and read off a list of your interests other than amateur radio, how about the editors of the club papers making a survey of these interests and publishing them so members can have them at hand for use during a contact? This might help get things moving and cut down on the number of blah contacts. Let's be reasonable about this – what is the use of our fantastic communications system if we hardly ever have anything to communicate? We can't sit there for months on end waiting for emergencies.

Another proposal: One possible use for ham computers would be to operate a synthesizer to check all nearby repeater channels, listening for some coded call. Perhaps we could decide on a two or three Touch-tone sequence that would be used for calling a particular station. The computer would then constantly check all available channels looking for the first of these tones, perhaps sweeping them all several times a second. The first tone would stop the computer and it would then wait for the second and/or third tone before alerting the op that a call was waiting. This could all be done without a computer, but it would take some hardware . . . and a computer could do most of it with a program and little hardware. Any articles coming on this?

End of proposals for this month.

FCC – HURRY UP!

It's difficult enough to get new blood interested in amateur radio without having to contend with interminable waits on the FCC. Recent club newsletters mention waits of three to four weeks for license exams for Novice and Tech tests. Then, once the test has been administered, comes the real test of patience, with three to four months getting to be the usual wait. This just isn't fair and Friendly should get on the stick and fix the problem.

Another *big* hangup is in the acceptance of ASCII code for RTTY uses. It was bad enough having to wait out the years it takes the Commission to make a simple decision like this, but it was recently aggravated by permission to use ASCII for Oscar work on a special temporary basis. This is *just one more case where the* FCC is blocking amateurs who want to keep up with the state of the art, forcing them to use antique communications methods.

Not that amateurs will put up with such nonsensical restrictions forever. Word is seeping out that several amateurs are working on a clever system of upping the Baud rate for RTTY communications. One way is to take advantage of the lack of any restrictions on Morse code speed or bandwidth and convert high speed Teletype (usually in ASCII code) into Morse, send it at about 200 words per minute, and then convert it back to ASCII again at the receiving end. This can be done on either end via some ICs or with a programmed microprocessor system . . . hardware or software, if you prefer. Computers talking to computers.

Suggestion: If you have a little spare time, why not spend it writing a petition to the FCC asking them to expedite ASCII on the ham bands. You might ask them to take off the restrictions on Baudot too, permitting any speed. Look over the regulations and where you find restrictions that are not really needed, petition for them to be removed so we can work on new ideas and communications systems without forever having to worry about breaking this or that totally unnecessary rule.

Look for an FCC investigation of financial records and public service records of closed repeater groups.

CLOSING CLOSED REPEATERS?

The feelings of the FCC with regard to using the amateur bands for commercial purposes are not any secret. It thus should not come as any surprise that there is growing unhappiness in Washington over the closed repeater situation.

For starters, the question is asked: With all the open repeaters on the bands, is there any proven need for closed repeaters? Then they want to know if it is really consistent with amateur regulations for any public amateur frequencies to be closed off by a small group for their personal use.

With fees as high as $500 per person per year (a very, very closed New Hampshire group, reportedly), isn't that gross commercialism? The closed repeaters have been aggravating the situation by telling visitors to get the hell off the closed repeater, by just ignoring nonpaying call-ins, or even by turning off the repeater for cashless customers.

Now that channels are getting difficult to find for free and open repeaters, many repeater groups are getting irritated by the high-handed actions of closed repeaters. Perhaps some accommodation for closed repeaters can be worked out whereby they are assigned channels by the frequency coordinators on a secondary use basis, with the open repeater on channel having the use of the frequency on a priority basis. An interim solution would be for closed repeaters to move to splinter channels, but this certainly won't simplify the FCC's growing interest in the play for pay aspect.

Look for an FCC investigation of the financial records and public service records of closed repeater groups.

Readers who have reports on closed repeaters, pro or con, can send them to *73*. A lot more light needs to be shed on this problem.

COMPUTERS AGAIN

I see where an outfit in Phoenix is building an alarm system into their cable TV setup which polls the individual houses to make sure everything is okay. Once every six seconds the minicomputer system checks each house – there are sensors for fire detection, burglary, etc. If any troubles are found the computer prints out the situation in the appropriate place: fire, police, medical, etc.

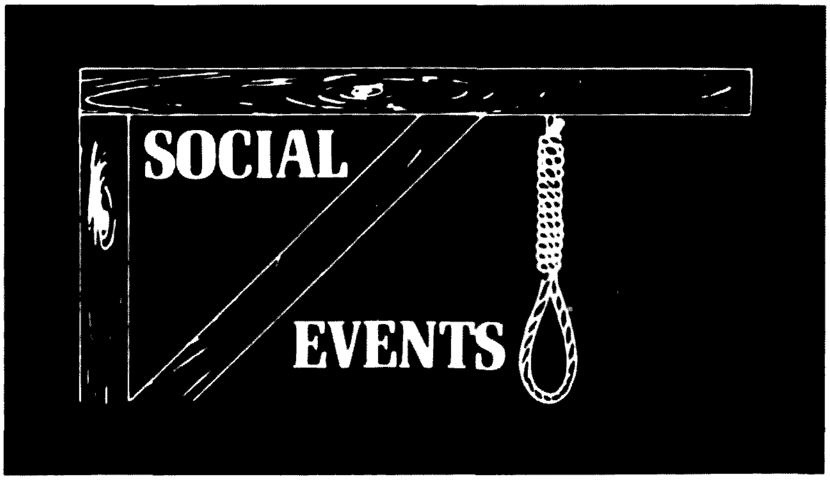
W4API sent in the clipping with a note that amateurs could set up a similar arrangement via repeaters with a microcomputer system to poll the repeater group members. He's right – we could get something like that working . . . any takers?

RTTY ARTICLES NEEDED

Digital ICs have brought on some new RTTY circuits and I'd like to see more of them in *73*. The door is open. Let's have some simple terminals, some complex ones, some autocall circuits, more Baudot to ASCII and back converters, Morse to ASCII and back, television typewriter terminals, end of line indicators, cassette storage of forms, and so forth.

The development of the TV

Continued on page 220



HARTFORD CT
NOV 1-2

The 1975 New England Division ARRL Convention will be held at the Hartford (CT) Sheraton and Civic Center, November 1-2. For exhibit space contact Carleton Dane W1FXK, PO Box 431, Canton CT 06019.

MASSILLON OH
NOV 21

The Massillon Amateur Radio Club presents the 14th annual flea market and auction on Friday, November 21, 1975 at the Amherst Park Civic Center (Amherst Park Shopping Center Complex), corner of Lake Avenue and Amherst, Massillon, Ohio. Flea market opens at 6:30 pm. Auction and all drawings – 7:30 until 11 pm. Donation at door: $1.00. No charge for flea market tables. Refreshments available: coffee, cider and donuts. Auction rules: no minimums; bid your item back w/no penalty. Commission 10%. Electronics items only and no children under 12. For more information write MARC, Box 8711, Canton OH 44711.

NEWTON MA
NOV 28

The Middlesex ARC's annual auction is Friday, November 28, at 8 pm at the Mason-Rice School, 149 Pleasant Street in Newton, Massachusetts. Club share is 15%. For more information contact WA1JWQ, 16 Beals Street, Brookline MA 02146.

SANDUSKY OH
NOV 30

The Erie Amateur Radio Society's fourth annual Thanksgiving auction will be held on Sunday afternoon, November 30, 1975 at the Laborers Union Hall, 2109 West Perkins Avenue, Sandusky, Ohio, across from the New Departure plant. Doors will open at 11 am with the auction starting at 1:30 pm. Admission $1 per person, no commission charged for auctioned items. Simplex call in on .52. Free coffee while it lasts. Plenty of parking, good restaurants in the area. Bring your extra gear that you couldn't pedal in the summer flea markets, and it will sell at the auction. Door prizes will be cash. It's a go – rain, shine, snow or earthquake. Auction only, no swapshop.

Looking West

from page 15

WCARS War Chest. The purpose of this is to have the funds necessary to bring one of these sickies into court and cost the jammer where it hurts most: in the wallet. While they are still soliciting financial support, the time has come that action can be taken.

As the reprint of the poster says, there is now a price on the head of every jammer anyplace. It can be a HF or VHF jammer, they don't care; all they want is one that they can prosecute. Therefore, the reward – a quick hundred bucks for turning in a rat and either getting his license suspended or revoked or getting a criminal conviction against him. There is the incentive, though it is indeed a pity that such is necessary. While others are content to procrastinate, at least WCARS is taking the bull by the horns.

Finally, in closing this month, a final comment on .16/.76 vs. .76 simplex. I had hoped that by this time I would have heard from SANDRA, the sponsors of the ill-fated .16/.76 system on Mt. Laguna. WR6AJL is still in operation, but has moved to 147.75/.15, though at this time it is still considered uncoordinated by the SCRA. I do believe it is the responsibility of anyone writing a column such as this to present all sides in a matter such as this, since in the long run it can effect an entire nation. Therefore, my offer still stands to publish their side of the story if they wish. To that end, I add the following extension to my offer. Send me a letter on your official organizational stationery, signed by your board of directors and expressing your viewpoint on the matter, and it will be printed in this column without editing or comment by me, period. A free, open format for your stand. Your side of the story has a right to be heard!

. . . WA6ITF

Some of WB6JQX's students get a demo of 2m FM from WA6ITF. Photo by Sharon Pasternak.

FOR YOUR EYES ONLY

from page 3

construct a PLL without much trouble. There is a good discussion of all the basic elements of PLLs: phase detectors, voltage controlled oscillators, mixers and counters. Much of the book is adaptable for using such circuits as the 561 PLL.

The newest item in the hobby IC scene is the microprocessor. The Intel 8008 can now be purchased for about $30 and the 8080 for about $200. There is not yet an extended literature on these devices. However, Motorola now has two manuals for their M6800 microprocessor. These books are specifically for this microprocessor, yet they are quite useful because the information can be adapted to almost any other microprocessor (if the difference of the instruction set is taken into consideration).

M6800 MICROPROCESSOR APPLICATIONS MANUAL
Motorola, 714 pages, $25.00.

This book is expensive but worth it to anyone who seriously considers building a microcomputer. There are descriptions of microprocessor systems and wiring, as well as of each microprocessor instruction and its interrupt system. The book is a good learning tool for those interested in microcomputers (both hardware and software), and contains routines for doing arithmetic operations. The major sections of the book include input/output techniques, programming techniques, peripheral control of cassettes, floppy disks, keyboards, etc., and system design. This is probably the best book available for persons interested in this area of electronics.

M6800 PROGRAMMING MANUAL
Motorola, $10.00.

This manual supplies detailed instructions for the construction and use of a microcomputer using the 6800, including a description of the interfaces to teletype and phone. Unfortunately, this book assumes some knowledge of computer technology, such as knowing the uses and meanings of busses, registers, masking, etc. This book does not have the general usefulness of the preceding, but if you plan to use a 6800 it will be indispensable.

For the professionally dedicated amateur, hobby clubs, or an available technical library, there are two additional encyclopedic IC information sources.

IC MASTER UPDATE
645 Stewart Ave., Garden City NY 11530, $30.00.

This book is on the expensive side, but it is the size of a Manhattan phone book and is updated annually. It provides a listing of the names and addresses of 73 manufacturers (and their distributors) of digital, interface, linear and memory integrated circuits. An extremely useful table is an index to all ICs, making it possible to identify almost any linear or digital circuit. A master function index is provided, which lists all of the various ICs by function and class; for example: Digital, CMOS, Dual JK flip flop. There is a manufacturer's catalog data section which samples about 26 companies and about 500 different circuit types. These appear to be very new devices, although I have seen a few in surplus ads. I found it interesting just to see what kind of circuits are being made beyond the simple logic of the common TTL circuits. The catalog section also serves as a kind of text, showing what these specialized devices can do should you build something like an asynchronous receiver-transmitter in connecting your microcomputer to a teletype machine and to a phone. This book is very useful for identification of a device and its ratings. Its only fault is that it does not include circuit details such as pin connections, inputs and outputs.

DIGITAL INTEGRATED CIRCUIT D.A.T.A. BOOK
DATA, Inc., 32 Lincoln Ave., Orange NJ 07050, $40.00 (two issues annually).

This is another comprehensive book on about 16,000 digital integrated circuits. It provides a cross index of all digital integrated circuits, classified into the following groups: flip flops, clocks, counters, decoders, gates, time delay, ADC, DAC, line drivers, multipliers, arithmetic logic units, and microprocessors. For most, logic diagrams and pin diagrams are included; generally, though, insufficient information is provided, so that it would be difficult to use one of the more complicated circuits without additional data. This book is good for the purpose of identifying circuits, but suffers because it does not include memories and linear integrated circuits. This company does have other issues on linear and MSI-LSI memories, but they are equally expensive.

. . . W3GAT/2

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ELECTRONICS BENCH MANUAL
Technical Documentation, Box 340, Centreville VA 22020, $19.95.

The amateur radio hobby is well served by many books devoted to the electronic circuitry of equipment and construction articles of specific transmitters, receivers and accessories. Most books assume that the reader will trust that the components specified are the best to use in this application. What happens where there is a problem to solve but no schematic with the solution? Where can one start selecting components to do the job? How must values be chosen? The ELECTRONICS BENCH MANUAL starts where the other standard works only give one or two chapters.

The ELECTRONICS BENCH MANUAL is component-centered, introducing the amateur engineer to many new ideas. To begin, there is a

guide to setting up an electronics workshop. I was impressed by the unpretentious approach taken here. The workshop described as practical is within the resources of anyone able to take up electronics as a hobby, yet hints taken from professional labs make it very versatile. It continues with a section on soldering, printed circuits, chassis layout and construction, which will allow the builder to produce professional looking equipment instead of equipment which is only "cheap and nasty".

The semiconductor section is an answer to the plea of many amateurs, "What do those numbers in the advertisements describe when they say 741, 555, 7490 or 74199?" General transistor theory is presented clearly, as well as listings with pinout diagrams for the TTL MSI series and the National linear IC line. Five pages of text and twelve schematics for application of the NE 723 cover power supply regulation. There are twenty-four pages of diode, transistor, operational amplifier, and digital circuits, and a four page description of the fascinating NE 555 timer.

Following the semiconductor section are sections on tubes, resistors, capacitors, inductors, transformers, switches and relays, wire and cable, meters and displays, energy sources, mechanical devices, and hardware. The exciting characteristic of each section is the simplicity in detail. Assuming that the user's resources are limited, it does not embarrass the reader with ideas which belong only in the Hewlett-Packard laboratories, yet it encourages him to utilize the many components available to most efficiently do his job.

The manual is rugged and easy to use as well. Solid polyethylene covers take rough handling right at the work bench, while the three ring binder format makes additions to the manual or removal of pages a "snap". If you can use much practical information you can use this manual in your library.

... McCarthy

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73 solicits reviews of current titles having to do with amateur radio and its periphery. While payment varies according to the size and quality of manuscripts, it is nonetheless uniformly generous. Contact Book Reviews, 73, Peterborough NH 03458.

CONTESTS

from page 11

The 6th annual ARRL 160 Meter Contest is open to all amateurs on CW only. Multi-operator work is permitted and scores will be listed separately in the results, but they will not be eligible for certificates.

EXCHANGE:

RST and ARRL section or country.

SCORING:

QSOs with amateurs in an ARRL section count 2 points; QSOs with amateurs not in an ARRL section are worth 5 points. DX to DX QSOs do not count. Multiplier is the total number of ARRL sections (74), VE8, and foreign countries worked.

AWARDS:

Certificates will be awarded for section and non W/VE country high scores. Division high scores will have their section award endorsed with an appropriate seal.

FORMS:

It is suggested that contest forms be obtained from ARRL, 225 Main St., Newington CT 06111. Check sheets are not required but a penalty of 3 additional contacts will be made for each duplicate contact.

These rules were taken from last year's contest. For complete rules, see the November issue of QST.

RESULTS OF 1975
HELVETIA 22 (H22)
CONTEST

European Scores:

Country Leaders

DK5EZ	11,070 pts.
DM3GF	11,808
EA5BS	11,610
F8OQ	3,087
FC9VN	6,138
G3ESF	12,600
GW3INW	2,678
HA2RM	8,424
I3ZDN	2,508
LA9GN	756
LZ2KSB	5,616
OE2RIL	1,428
OH2DW	4,788
OK3ØKFF	11,952
OZ3WG	9,702
PAØALS	4,089
SM2DMU	2,244
SQ9ABE	11,970
UA2FAW	924
UA3AFQ	1,620
UY5LO	8,103
UK2PAF	2,775
UR2QD	11,040
UK2GAN	2,232
YO2BLO	75
YU2HDE	10,680

Non-European Scores:

Country Leaders

JE1HJJ	12 pts.
KP4DPN	216
W1CNU	702
LU2AHI/W2	1,218
WA2HZR	1,218
W3GFB	1,734
WA5VDH	450
W8VSK	897
W9OHH	702
OA4ZP	612
UA9CBM	429
UL7NAA	288
VE3UOT	1,092

RESULTS OF 1975
FLORIDA QSO PARTY

Top Florida Club Score:

W. Palm Beach ARC . . .
197,531 points

Top Florida Scores:

Phone

WA4LZR	85,157 pts.
WA4IMC	66,240
W4OZF/M4	36,051
K4ELK	33,096
WB4YLG	28,448
WA4UFW	24,035
WB4PQB	19,551
WB4NXR	16,555

CW

K4VFY/4	45,792 pts.
K4VW	44,064
WB4AEX	41,202
W4BRB	30,256
K4HWW	29,698
WB4TAF	27,720
K4AIZ	21,831
WB4SKI	21,252

Top Out of State Scores:

Phone

CG3GCO	7,072 pts.
WØIUB	2,132
W8WT	1,386
WA1QNF	1,344
K9KKX	644
WA9MGY	507
W1LQQ	504
VE3EJK	468

CW

WB8FUO	4,448 pts.
WØPRY	2,548
W9NII	2,300
K9DDA	2,280
WA1QNF	2,250
W5WG	2,184
W7GHT/7	2,054
W1AQE	2,047

LETTERS

from page 8

24 hour a day watch also! Just three men made the watches come around pretty often – all for $79.20 a month, plus S1.95 a day for being on detached duty! The S1.95 a day was commuted rations, and we had to feed ourselves. We ate in a big Chinese restaurant – mighty fine food!

Anyway, I set up my ham rig after I got the Navy station working, and I had a windom (single wire, off center fed antenna) cut for 20 meters. Also had one cut for 40 meters but ran into too much QRM on 40 to be able to do much good. Although the west coast came in pretty well on 40, 20 was the best.

I was rather surprised to find that from Chungking on 20 meters my signals were apparently going the long way around via Europe and that I was doing really good into the east coast of the US. Used to get on there around 6:00 am, which was around 6:00 pm on the east coast, and man, did I work the boys back there! For the majority of them I was the first XU station any of them had ever heard, let alone work!

Had a sked with W2CMY and worked W2GT and W3EMM very often also. I worked a whole bunch of the members of the Frankfort Radio Club around Philadelphia. I worked them in order and sent the QSL cards to their communications manager – and he doled them out. I could send my cards out with US postage via the diplomatic pouch, with a better than average chance of their getting through. Mail took about 40 days from Chungking to the east coast. It went out via air to Hong Kong, and later out over the Burma Road to Rangoon.

Also had a weekly sked with AC4YN in Tibet. I fixed up a couple of guys in the USA with a QSO and at that time there were only about three guys in the US who had worked him. They formed a little club called "TWA" – for Tibet Workers of America! I remember seeing a little squib in *QST* about it – somebody sent me a copy. I also got chewed out by a couple of hams in the US for being some kind of phony in Europe using an XU callsign! There was one guy who wrote a very indignant letter to the ARRL about this phony in Europe! At the time I didn't dare be too specific as to my location – ham radio was *verbotten* in China, and since I was in the wartime capitol of China, *and* living in the American Embassy, I was pretty cautious for some time about telling people where I really was. It took a couple of months before the word got around in the States that I was legitimate – and where I was.

Later on, I got chummy with the Chinese Vice Minister of Communications and he told me it was OK for me to operate on the ham bands unofficially. He couldn't really give me a Chinese ham license, but I was not to worry – and be sure I didn't say anything much about the Chinese-Japanese war then in progress. I thus managed to stay on the air with no worries. I only operated about 16 months, but I sent out over 5000 QSL cards all over the world in that time.

I could make WAC from XU4XA in 15 to 20 minutes any evening – signals were something else! All I had to do was make one short CQ and, from then on, everyone seemed to be calling me! On the mid watch (1:00 am to 8:00 am), there seldom was much traffic, so I used to shift over to 20m CW and work all over. Europe, South American and Africa were always in there; the US started coming in around 5:30 am and stayed in until around 10:00 am. I didn't have a vfo in those days, but I had about ten 40m xtals that did a pretty good job of spreading my frequencies around. I had to change frequencies a lot of times because of the pile-ups, but we managed!

Anyway, we had to move to a new embassy up on top of a hill, and, as I only had a few months left to do on the job (I wanted to go back to the States, having been in Asia for over ten years), I decided to sell my rig. The Chinese government bought it, lock, stock and barrel – including my spare parts (which were almost impossible to get in wartime China) – for about six times the price the rig had originally cost me! I understand they used it as a guerrilla station with Chinese operatives behind the Japanese lines. Wonder what ever became of it??

I left Chungking in August of 1940. We had to fly out and were limited to 30 pounds of baggage, so I packed up about 4000 of my QSL cards, all my logs, my old bug that I had used for about 10 years as a Navy operator, and, together with a few odds and ends I had accumulated, had it shipped out over the Burma Road, to Hong Kong. When a Navy transport came in, it was supposed to be sent on to me in the States.

However, it took several months to get to Hong Kong, and before it could be forwarded to me, the World War Two business broke out and that's the last I ever heard of my little foot locker! I would rather have lost a left leg than 10 years' accumulation of QSL cards and all my ham logs, but that's the way it went! I have no idea who I worked from my various QTHs out there, with a few exceptions. I don't even have a single one of my old XU QSL cards! Met a guy once after the war who had one, but he wasn't about to part with it! He was a radio engineer with the Voice of America here in California, and I had worked him when he was a W3 back east. Boy!! Most of those cards I had would be a real curiosity these days! AC4YN, all kinds of Europeans, Africans, South Americans – plus all the ones I got from the Ws over the years!

Well, I finally got back to the States around September, 1940. I visited my family, then went to Philadelphia and put a new seaplane tender in commission. We went through the Panama Canal and to Honolulu, and I was there on Pearl Harbor Day. The ship was kamikazed and bombed; I lost all my transmitters due to fire and explosion, plus five of my radiomen. I was the maintenance chief, and finally got out of the operating after about 12 years. I spent the whole war in the Pacific, and finally caught another kamikaze in Okinawa that put us out of commission until the war was over – and also killed a few more of my radiomen.

After the war was over I got sent to a 6 month advanced teletype maintenance school. Then, after over 18 years of continuous sea and overseas duty, I got sent to the Navy's first teletype operator school on the east coast, at Bainbridge, Maryland, as chief instructor. When that base closed, I went to Norfolk, Virginia, in the same job. Norfolk decided me to retire, which I did.

Came out to California and went into the dry cleaning business here in Sacramento, with my brother-in-law. Then, when the Korean War started, I was recalled to active duty and was sent to Guam as chief in charge of the teletype maintenance shop there. Busy? We had over 200 teletypes on the line at all times!

Then I was sent back to the States

and was chief in charge of the Navy's high power, high frequency transmitter station at Dixon, near Sacramento. That was NPG and we had another station in Mare Island with about 200 transmitters of all types on the floor there. It has now been shut down for many years and all the west coast Navy transmitters are at Dixon – we had 1280 acres there and more antennas than you would believe!

After the Korean War I worked as an expediter for a big electrical contractor here for awhile, but lots of strikes and labor troubles occurred, so I went to work for the US Army at the signal depot here as an electronic technician. Worked for them for 19 years, and about 3-1/2 years ago I finally retired for good with over 42 years service with the federal government.

I like this seven day weekend deal (with pay) – but I get less done now than when I was working a 40 hour week! I get just a shade over $12,000 a year in pension, so do pretty well. Manage to buy a bottle of good scotch now and then! Hi!!

I have a ham rig here, and some old Navy receivers that pre-date WW-2. Also have a Collins 75S1, a Heathkit SB-401 transmitter and one of their 2 kW linears (which I have never used) – plus several xmtrs I built. I don't do too much hamming, but am quite active in Army MARS. I work about 4 skeds a day and handle around 200 or more messages a month – the "morale" type messages from troops overseas to their people in the States.

Had to go SSB to keep in the swim – not too many good CW operators left anymore – but I do work about 8 CW nets a week in Army MARS. Also have a Collins 51S1 receiver (general coverage job).

Well, I've run on at some length, but thought you might like to know what happened to XU4XA in the past 37 or 38 years! Guess you are still active on the bands. I enjoyed your article in *73* and it got my mind running way back when, so I thought I'd drop you a line. Hope it is of interest to you.

Al Lower W6CLB, ex-XU4XA
3916 Arden Way
Sacramento CA 95825

NUMBER ONE

Dear Wayne,

In your May issue, you published my letter regarding my problems contacting a local club and the "boorish" behavior of the 2 "hams" I tried to contact on my own.

I received no less than 1 dozen replies, and thanks to WA3IFY (Jay Kuperman) I will be starting classes at the end of September in a local club he put me in contact with.

I personally want to thank you, Wayne, for the copy of *Novice Class License Study Guide,* which you were so kind to send me. I have also sent for and received your 5 wpm code cassette, which has already helped me get a head start on that code.

As far as I am concerned, *73* means #1 in amateur radio magazines. Thanks again and 73.

Charles F. Super Jr.
Philadelphia PA

COLLUSION?

Regarding "There's Always Hope", *Be My Guest*, September, 1975:

This goes to prove at what end FCC will go to make them look like the good guys. I'd say collusion! I once tuned across the 40 MHz band and heard one of the kid wonders, called CQ for nearly three 3 minutes then a long pause – then came loud and clear what do I say now dad? What price publicity?

G. B. Post W6BYP
Nice CA

SUPER SPECTRUM

I guess I am one of the original subscribers to the magazine, as I caught you at the Dayton Hamvention many years ago and subscribed on the spot. I think it was 37¢ per issue then and I've never regretted it a bit. It's still the finest on the market and I still enjoy browsing through the back issues to pick up bits of info that can still be used today. I seldom if ever have too much to say about your advertisers and if I get stung I usually take my beating and don't go back for seconds.

I think you should know about Spectrum Communications, as your review of their product caught my eye and I purchased one of their repeater receiver boards a month or so ago. I still don't believe it!

This Spectrum board surpasses anything I've ever seen. The sensitivity and lack of intermod is something to be seen and appreciated. I can't say too much for Joe deCourcelle and his fine group, as they have taken a personal interest in my new repeater (using their equipment) that is above and beyond the interest usually shown to any customer. I expect to have the transmitter board this month, as well as one of their 12 channel units for my mobile. In both the old repeater and the new one, I am using Peter Stark's excellent digital control system and IDer that appeared in the February and March 1973 issues. It works like a dream and he too has been of help in getting us over the rough spots.

As of September 1, the receiver and control circuits were complete, and in shakedown testing on a 24 hours a day, 7 days a week basis I've had no problems with either of them. The new repeater is a desk top, rack and panel, set up with individual power supplies for each unit and set up for either dual antennas or duplexer use. It has the Data Signal 12 tone decoder board which I built from their excellent kit and will be set up for autopatch using a control circuit designed and built by one of the local hams and now in use by the Wyandotte, Michigan repeater group.

Keep up the good work. You and your fine group are responsible for many of the improvements in 2 meter FM – and are a real credit to ham radio.

Lee Pennington K8OVJ
Lincoln Park MI

BEDSIDE CHAT

Here is a hint I use when printed circuit parts are removed and I want to enlarge or make a hole in the solder.

I take a piece of element wire (chrome plated) and push it through when I heat the solder. The solder doesn't stick to chrome. I have even used a short piece cut slanted on the end for a drill to drill small holes. It's slow but sure, especially if you have a variable speed drill.

I use it to make shunts in series with a milliammeter to get correct charging current for my nicads.

I use a light bulb in series with my small ac fan to slow it down to half speed. (I use the same wattage bulb as the fan.) It puts out almost as much air and will last a lot longer. An added feature at night is that it makes a good night light, too.

I use neon (NE-2) bulbs with a 22k resistor in series in my pencil soldering gun and solder sucker. This way I can tell if it's on without burning my

hand. I also use a light bulb in series with them, but I have a shorting switch so I can get full power in minutes by just shorting the bulb out. The iron won't burn up nearly as quickly this way and it's hot when I need it to solder small jobs (with the bulb still in series with the iron). This comes with many years of experience like using the piece of braid off shielded wire to soak up solder.

I'm bedfast, so I keep a lot of "junque" on the bed. A 2' x 3' sheet of ¼" plywood with about #10 copper wire, masking taped to the top edge all the way around, makes a good workbench and things won't roll off with the wire there. The masking tape also covers the edge and splinters.

I built the voltage regulated power supply in the May, 1975 issue (pages 85-87) and it worked a few minutes and then quit. I found the 723 V.R. had blown. I put in a new one and it gets hot. I haven't found the trouble yet.

S. D. Sales has a special on the 723 free, if you buy the MJ-3001 at $1.99, as advertised in *73* mag. They are sure a fine company to deal with. If any of their parts go bad, I write them and they replace them free, postage and all, and sometimes throw in some free parts, too. They don't ask for the bad parts, either.

I have a large ash tray, so I used some #16 copper and went clear around it with some indentations in the top to lay my soldering pencils in. Now no more burned wires and bed sheets. Just don't touch the wire while it's hot.

If I stick tapewriter labels on something like xtal markings on the 2 meter rig, I clean it first with lighter fluid. If it comes loose, I use some Scotch tape over it.

On the children's band (CB) radio one night I heard a fellow tell another one about 2 girls spending the night with him – and he even told their names and where they were from. I guess it pays to advertise. Hi!

I've heard about everything on CB possible, from little kids singing a complete song, tapes, and fights over whose channel it was. I listen for fun when I don't feel like working on something or building – and sometimes when I am. Maybe that's why some things don't work. Hi! I picked up big mama on Ch. 6 TV one night clear across town from here. She said someone was griping about hearing her on an adjacent CB channel, so I checked and I could hear her 3 up and 3 down and more – except they were being used. I've heard she has a linear and an amplified mike. Thanks for listening . . .

Lee Lanterman
Frederick OK

PROMPT RESPONSE

I want to thank you for the prompt response to my orders for books and tapes in the past. I would also like to say that I think *73 Magazine* is the best ham publication around. Wayne Green is to be commended for his time and effort to help struggling future amateurs like myself with the code and theory. Keep up the good work!

John Wingard
Columbus GA

NO CHALK

Observed, written in chalk, on a Union Pacific boxcar passing through Salt Lake City on August 30, 1975: "W2NSD QSL". Thought you would be interested.

Dallas Barrett WA7MEL
Salt Lake City UT

Interested, and perplexed. I visited Salt Lake City in early August, but didn't have any chalk.– Wayne.

DIRECTIONS

I took advantage of your subscription and code tape offer just a few months ago and have already found that the benefits have been worth the price.

Listening to W1AW was fine to a point, but it was the tape that put me over the hump. I passed the General code test with ease. Your *General Class License Study Guide* was invaluable in helping me put all the required technical knowledge together on the written exam. I'm sure that the *Advanced Class Study Guide*, that I purchased personally from you in Rochester in May, will help me obtain the Advanced class ticket on the first try.

As far as the magazine is concerned, I've enjoyed the mixture of technical and narrative articles. I found the article by Paul Rudolph WB6OMT in the September 1975 issue entitled, "Full Break-in at 60 wpm?" to be very timely. I'm now keying my transmitter, activating a sidetone and muting my receiver very simply and reliably. Prior to the article's appearance I had concocted some wild schemes to do the same thing!

So keep those comments, articles and projects coming, Wayne!

One favor – please give directions on how to reach your offices once in Peterborough. On my vacation in July my XYL and I drove around town quite a while without finding your location.

Steve Zahas
Williamsville NY

Get on U.S. 101, east of town, and look for towers. – Ed.

KAPUT

I've been an inactive ham for over 3 years (my wife says I was born a ham and am never inactive), and just got back on the air by putting a 2m FM rig in the car. I now find that all my hard-won theory is kaput because some wise/guy got tired of writing about grids, plates and filaments, and got people thinking about little bitty plastic things with something called emitters and collectors inside!

Now, as if that wasn't bad enough, some other clown took a bunch of the above plastic doohickeys and mixed them up with a lot of ——/\/\/—— 's and ——|(—— 's. He must have then rolled them out flat and stuck about 16 (yes, sixteen) little wires onto it and called it an IC.

Now I ask you, is that any way for an otherwise nice bunch of guys to act while I wasn't looking? Where in the hell do I plug in a spare 6LQ6 in one of those little boxes? And where, oh where, do I attach the +250 V from my trusty supply with the 141b transformer?

And worst of all, what do I tell my 11 year old son (whom I encouraged to study for his Novice exam) when he asks me, "What's the difference between a common cathode and a common anode LED, Daddy??"

I would also like to start building accessory items for 2m FM using those plastic thingamajigs, but I can't decide which would be a more suitable how-to-do-it book, *The 2m FM Handbook* or *VHF Projects For Amateur and Experimenter*. So, I'm tossing it in your lap. Pick one and send it.

Bear in mind that a dummy like me needs more than just a schematic to make it work. As an example, do my chassis punches still work on that plastic stuff with the copper on one side?

Seriously, thanks for writing *How To Use FM.* It was a big help in avoiding the major errors when I first fired up the 2m FM rig. The XYL here has a question, though: When the girl on the cover finally puts on her blouse, does the carry strap go over it or under it?

Jeff Combs WA2ASO
Turnersville NJ

If Judy Repeater ever puts on her blouse we could be in a lot of trouble – it can't be just the listings of repeaters that are selling all those Repeater Atlas's. About that +250 . . . how about a big red switch on the front panel, mount it insulated with a "self-destruct" sign and hook that to the 250? – Wayne.

GOOD GUYS

Please send the 14 wpm cassette and put my name on your subscription list for at least the next three years. I've got the last couple issues from one of my local amateur dealers and have been quite impressed with your articles and construction projects.

I hold a 1st class FCC phone ticket and make my living maintaining and doing system design on a business band communication system and, as a result of this, I am probably more critical of construction projects than most readers. I've read a few issues of *QST* and find myself wondering if the authors have an insatiable need to see their name in print or if they're deluding themselves into thinking that real people build things like that! They seem to see just how many odd-ball parts they can get in a project and it couldn't be any good unless it costs two hundred bucks.

Keep up the quality of your magazine and be assured that your subscriptions will multiply and be happy. The good guys always win in the end!

William E. Adams
Columbus OH

8-33?

It is not that I admire the "code phrases" or ten-codes on citizen's band, but there may be some need for abbreviated phone signals for rapid, or more rapid, communication, or for more concise meanings, such as the following (now being used to some degree in this area):

8-01 . . . You've got to be kidding!!!
8-02 . . . Get off my back.
8-03 . . . He shut down an hour ago, so you can quit calling him!!!
8-04 . . . I hear you 5 by 9, but I don't want to talk to you!!!
8-05 . . . You're sure beautiful when you're mad.
8-06 . . . What do you expect, the W(8) – only got a 3 by 4 report.
8-07 . . . Use a dummy load, stupid!!
8-08 . . . Big deal, so what???
8-09 . . . Beautiful signal, simply beautiful.
8-10 . . . I give up, see you in the next pile-up.
8-11 . . . I've been had!!
8-12 . . . Sorry about that.
8-14 . . . May the great kahuna befoul your rf clipper.
8-15 . . . Great scott! Are you paid by the word??
8-16 . . . How about telling it to some-one who really cares??
8-17 . . . I just hope the FCC catches up with you.
8-18 . . . Same to you, fella!!!
8-19 . . . What was his call???
8-20 . . . Where's he at???
8-21 . . . I did not design the stupid rig!!!
8-22 . . . This has to be the worst contact I've ever had!!!
8-23 . . . Bug off, stupid.
8-24 . . . He is listening up ten kHz, so you can quit calling him on this one!!!
8-25 . . . He is working the DX by call area, so quit calling and wait your turn.
8-26 . . . He is working the DX from a list.
8-27 . . . The net on this frequency terminated half an hour ago, so how about you stopping the effort to check in???
8-28 . . . The frequency is already in use.
8-29 . . . How about getting on the right frequency for a change???
8-30 . . . Get on my frequency, stupid!!!
8-31 . . . You are only 5 kHz out of the band.
8-32 . . . Come on over for a cup of brew.
8-33 . . . Are you crocked to the eye-brows??
8-34 . . . Pardon me, sir, but I believe you think you are talking to someone who cares!!
8-35 . . . What's wrong, have you no antenna?
8-36 . . . Your deviation is only about four times too wide for the repeater.
8-37 . . . See you tomorrow, 73s.
8-38 . . . Terminating operations here.
8-39 . . . Who is calling me???
8-40 . . . What time do you think you have???
8-41 . . . You are too weak to under-stand.
8-42 . . . You are as strong as horse-radish, here.
8-43 . . . Let's change frequency.
8-44 . . . Listen for you up ten.
8-45 . . . Listen down ten for you.
8-46 . . . Why do you want to know??
8-47 . . . So and so covered you up, so try again.

There may be other phrases, but these are the ones known here.

M. L. Braun K8IQB
Bellevue OH

SORRY

A few months ago I entered a "first" subscription to *73* as a trial. I like your style. The technical articles, the editorials, Amsat information, and your ads are excellent. I am only sorry that I did not subscribe for 3 years.

R. C. Cunningham W3UJD
Pittsburgh PA

GIVING UP ELEVEN

Re "0-60 MHz Synthesizer", September issue, please note with interest the frequency pictured in the snapshot. It's heartwarming to know that there are still gallant stalwarts around who'd rather die than give up eleven meters. My hat's off to Mr. Calvin . . . 10-4?

Nelson Roberts WB6JFS
Westlake Village CA

THE 10-0 DECODER

Mr. Biddle (August, 1975, page 136) asked about a "descrambler" . . . our local PD uses a scrambler from time to time. 10-0 is their code for going to the device. The unit is very simple for this particular type of encoding. Anyone with reasonable ability in electronics should be able to build the device. I don't want to make an article about this . . . I feel that the police departments have enough trouble with the cons and crooks having monitors to listen in with.

Continued on page 221

Larry Kahaner WB2NEL
4259 Bedford Avenue
Brooklyn NY 11229

Flip Flops Exposed

The purpose of this article is not only to teach the basics of flip flops, but also to help the ham builder understand the circuits which he sees every day in magazines and construction project books.

All of us try to follow the builder's explanation of operation but may fall short of full understanding due to ignorance in certain shorthand notations or unfamiliar phrases such as "the flip flop is now set," or "it operates in a master-slave configuration," or more common, "the device will be allowed to toggle."

We decide to skip the explanation and build it anyway. It works, but we miss the Joy of knowing how it works. Hopefully, these intermittent knowledge gaps now can be filled once and for all.

The flip flop has an amazing talent: a memory.

This may not seem like much to you, but for a chunk of silicon it's quite an accomplishment.

This memory is the basis of all computers and counters. After all, what is counting but remembering what you had last? And the beauty of learning about flip flops is that there is no new background material with which to grapple. All that is needed is an understanding of the TTL primer in the July issue.

Take a minute and review the four basic gates and the action of the clocking input.

There are four basic types of flip flops. They are the R-S, D,T and J-K. All have two stable states, either 0 or 1. This is known as bistable. Sometimes flip flops are referred to as bistable multivibrators. Another name you might have seen is bistable latch. They are all the same thing, a form of the flip flop.

R-S Type

Fig. 1 shows the simple R-S flip flop or latch. The S means SET and the R means RESET. Other terms used are PRESET and CLEAR, respectively.

By convention, the outputs Q and $\overline{Q}$ cannot be equal. In fact, the bar over any letter means "not". $\overline{Q}$ is called "not Q".

To show the action, let's *assume* that Q = 1 and $\overline{Q}$ = 0. Because of the feedback loops

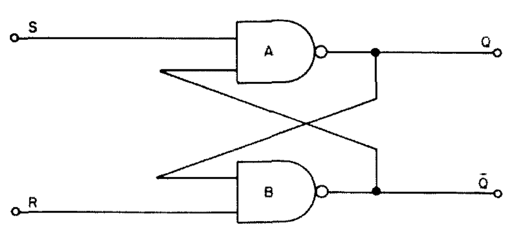


Fig. 1. R-S flip flop.

the B input is 1 and the A input is 0. For the initial state in the NAND flip flop (NOR gates can also be used) R and S are always 1. So we have the initial condition, as shown in Fig. 2(a).

If you recall the NAND truth table, only inputs of 1,1 yield 0; all other combinations give 1.

If we drive R to 0 the following chain takes place. The R input of 0 combines with the 1 input at B to make the output at $\overline{Q}$ = 1. This 1 feeds back to the A input and combines with the S = 1 input to make a 0 output at Q. This 0 feeds back to the input at B, as seen in Fig. 2(b).

Whew! But look what happened! Our outputs are reversed! Even if we return R to its initial state of 1, the output will still remain, as we see in Fig. 2(c).

That momentary driving of R to 0 could be a push-button or a clock pulse.

Now if we take our final condition of 2(c) and impress S to 0, the outputs will flip around again. And they will stay, even if S is returned to 1. See Figs. 2(d) and 2(e).

The name flip flop is thus shown to be quite appropriate.

A flip flop is said to be in the SET condition if the Q output is 1. The RESET condition exists if the $\overline{Q}$ is 1.

Fig. 2(a) is a SET state and 2(c) is a RESET condition. The rule: If a flip flop is SET, driving RESET to 0 will change the output. If it is RESET, driving SET to 0 will change the output.

The symmetry is beautiful. If it's SET, reset it. If it's RESET, set it.

But what happens if both R and S are impressed to 0? Well, that is the problem with the R-S latch. The answer is ambiguous. Since you never know which 0 came first, the output is unpredictable. Try it, and you'll see the fun.

A schematic diagram of a flip flop may show the actual gates or it may show a configuration such as Fig. 3(a). A personal favorite is shown in Fig. 3(b).

Either way, it indicates that something like what is shown in Fig. 3(c) may have been done with (for instance) the 7400 chip.

Not all flip flops will be made from chips containing *only* simple gates. Some ICs have

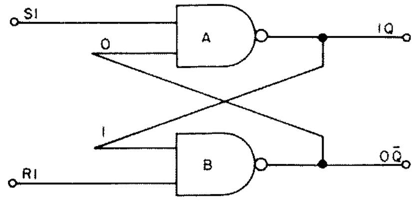


Fig. 2(a). Initial condition.

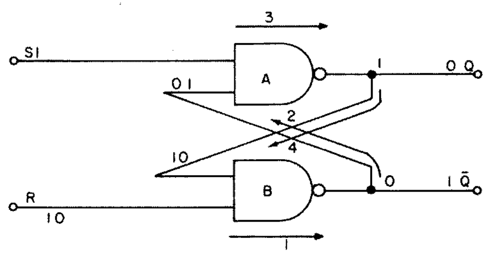


Fig. 2(b). Follow the action!

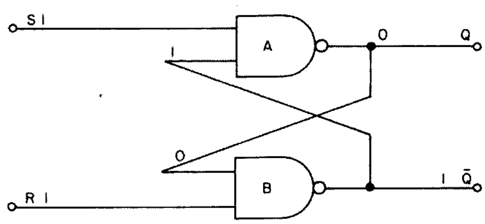


Fig. 2(c). Outputs reverse and stay, even though R is returned to 1.

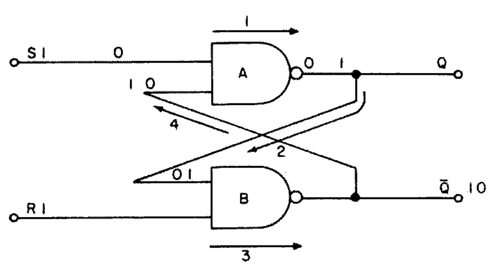


Fig. 2(d). S goes to 0 and outputs reverse.

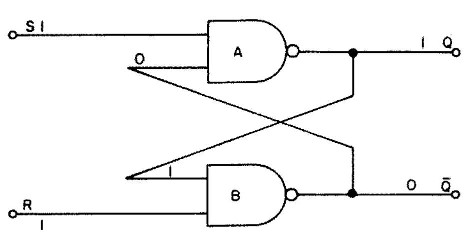


Fig. 2(e). Outputs stay reversed, even if S is returned to 1.

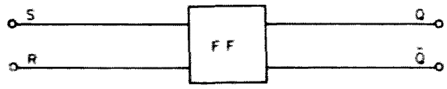


Fig. 3(a). R-S flip flop.

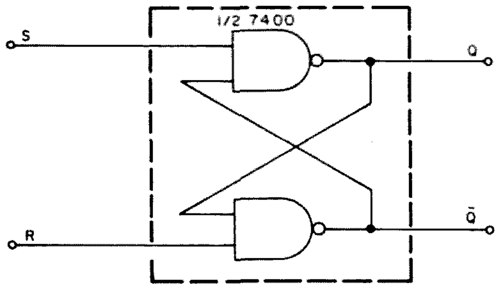


Fig. 3(b). Flip flop showing chip it came from.

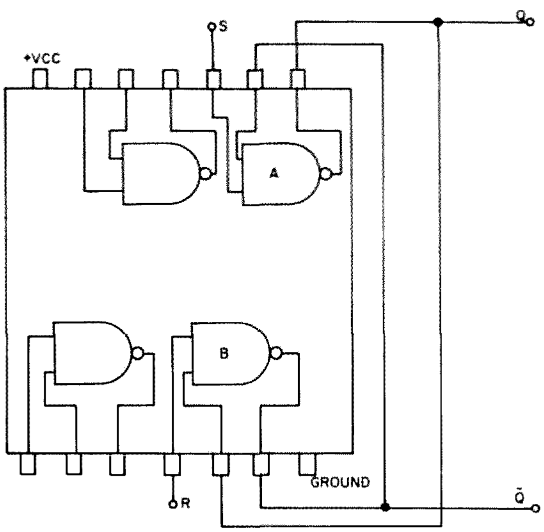


Fig. 3(c). 7400 wired in R-S latch configuration.

flip flops and *other* elaborate circuits within one package.

The R-S latch can also be made using NOR gates (Fig. 4). In this case the inputs are held low (0) and driven high (1) to start the flip flop function. It's just the opposite of the NAND gate flip flop, where inputs are held high (1) and driven low (0) to activate.

The NOR flip flop is not used much. It is easier to use NAND gates. They are also cheaper and more available.

In the NOR flip flop inputs of 1,1 are not allowed, just as 0,0 inputs are not allowed in the NAND configuration.

Clocking

Two types of logic circuits are used. One is synchronous and the other is non-synchronous or asynchronous.

Asynchronous operation exists when circuits are operating independently of each other. Each individual circuit has its own input and it responds to these inputs.

Synchronous operation relies on a common input such as a clock to feed all the circuits in the system. All functions rely on the clock.

If we add a clocking input to our R-S flip flop, two additional NAND gates are used. These gates insure that the latch works only when the clock pulse (1) is present. In Fig. 5 the input of C will be 0 only if the A input is 1 and the clock pulse is 1. Remember that the R-S configuration latches only on the 0 drive — and we have supplied it.

D Type

The second type of flip flop is the D or delay type. Since we still have the problem of the SET and RESET inputs being the same (causing an unpredictable output), the best we can do is to insure that we don't have the same inputs at the same time.

In Fig. 6 the inverter (E) negates all inputs; 0 becomes 1 and 1 becomes 0. We employ it to feed the B input. By placing it there while feeding it *and* A from the same input, we can be certain that the signals reaching the gates will be different.

Any signal going to A will remain the same and those passing through the inverter to B will change.

The D type can also have PRESET and CLEAR controls. They are superior or overriding functions. No matter what is going on, commands on these controls have priority. When either of these inputs is present (0), the output will go to 0 or 1 depending upon which function is employed.

In schematic diagrams, the letter "D" is the only indication of the flip flop type.

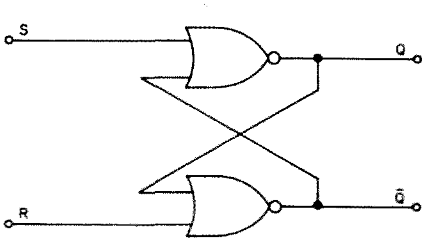


Fig. 4. NOR gated flip flop.

IC types which are D flip flops are 7474 (contains 2 flip flops with PRESET and CLEAR) and 7475 (contains 4 flip flops without PRESET and CLEAR).

T Type

The toggle or T type does what its picturesque name implies – it toggles.

The logic is such that the output will change regardless of what it was prior to clocking. But this only happens if the clock is fast enough. If it is not rapid, the output will change state and then return. It will forever change and change back again.

Toggle flip flops have been assigned mixed jobs. When a clock pulse is applied, the output will change once every input cycle. Therefore, it completes one output *cycle* (not just change) for every two input cycles. This gives a divide-by-two property which is used in counters and calculators.

Another use is in random output devices like "electronic dice" and "heads-tails" circuits, which electronics magazines are so fond of printing once a year. Since it is unknown where the circuit is toggling at the moment, a stop-toggling command will produce a random output.

J-K Type

The J-K flip flop is very widely used. The inputs J and K correspond to S and R. The gates 1-4 are the master section and 5-8 the slave section. Gate 9 is used as an inverter. (Although not shown, a constant input of 1 is kept on the other input. It will combine with the other input to invert it. 1 and 1 yield 0; 1 and 0 yield 1.)

Both sections are synchronous (use the same clock pulse) and are activated by a pulse of 1.

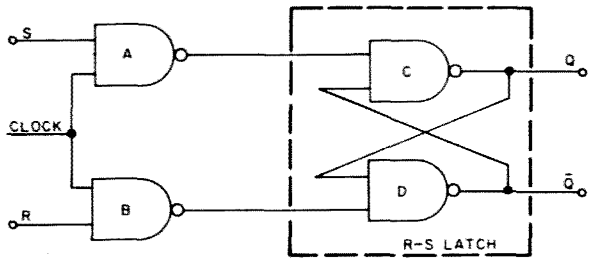


Fig. 5. Synchronous clocking of R-S latch.

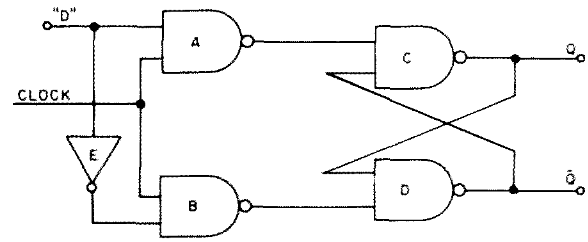


Fig. 6(a). D type flip flop.

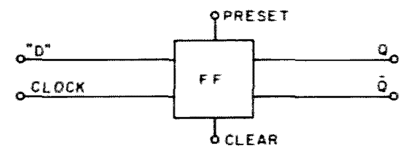


Fig. 6(b). D type with PRESET and CLEAR.

If the clock is 1, the master will see this and activate. However, the slave will see the inversion of this (0) because of gate 9, and not activate.

The feedback via lines a and b from slave to master will be valid until the clock pulse is 0. Then the slave will energize due to the inversion of this pulse from 0 to 1. But now the master is disabled because it sees the 0 straight from the clock.

The information is passed from master to slave. The next pulse will feed the output of the slave back to the master and so on.

A sequence of four steps takes place.

1. Isolate slave from master.
2. Enter information to master.
3. Disable master.
4. Transfer information from master to slave.

All this takes time. That is a useful property. A J-K can be used for storage of information while another circuit is doing something else. The two informations can then rendezvous at the proper time. The J-K also solves the same ambiguous input problem of the simple R-S. It's pretty good as a toggle, too.

Some examples of J-K flip flops are the 7470, 7473 and 7476. Each has a unique property such as number of flip flops, different voltage and frequency ratings, and different controls.

How the Flip Flop Counts (or, Here's the Part We've All Been Waiting For)

We have seen that it takes two pulses to return a flip flop to its initial state. If we

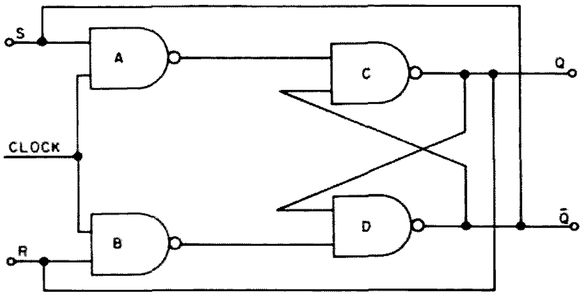


Fig. 7(a). T type flip flop.

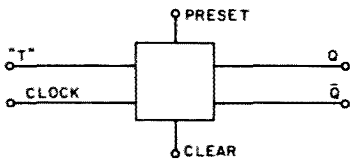


Fig. 7(b). T type with PRESET and CLEAR.

start with Q as 1, it will take two pulses to make it 1 again. The memory remembers the first pulse and waits for the next.

Therefore, if we monitor the output of Q we can tell when the input has completed two pulses. Since each flip flop counts by "twos", placing them together will allow the first to count by two, the second by four, the third by eight, and so on (Fig. 9).

Think of each flip flop as having two stages. Initially, all inputs and outputs are 0. Pulse 1 will energize a_1. Pulse 2 will return the first flip flop to its initial condition and store a pulse at b_1. Pulse 3 activates a_1

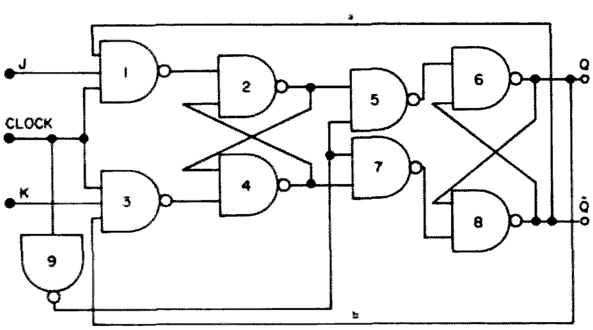


Fig. 8(a). J-K flip flop made from R-S latches.

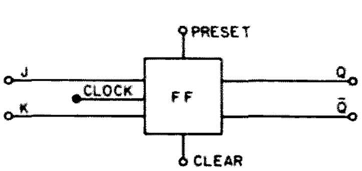


Fig. 8(b). J-K type with PRESET and CLEAR.

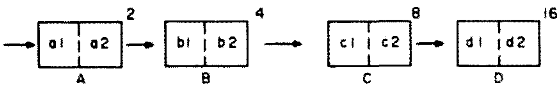


Fig. 9. Flip flop counter.

again. Pulse 4 flips section A and passes a pulse to b, where it combines with the pulse already there to flip section B. Our monitor at the output of B rings, buzzes or lights, and we know we have counted to 4.

After 16 pulses the entire counter is returned to 0. We have counted to 16!

Experimentation

Many readers have asked how to convert this type of "pure" knowledge into practical application. The IC mystique still lives! Just experiment. Buy some ICs and hook them up. See what happens when you do "this" or "that". There is no great mystery. They will work – really!

Here are some suggestions to help you play around.

1) Get a 5 volt power supply. It's cheap if you build one. The October, 1974 issue of *73* has a fine one. If you like printed circuits, Radio Shack has a board which is almost the same (except for part values). Parts are very cheap from the advertisers in *73*.

2) Monitor the output with some light emitting diodes (LEDs). They tell you if the output is high (1) or low (0).

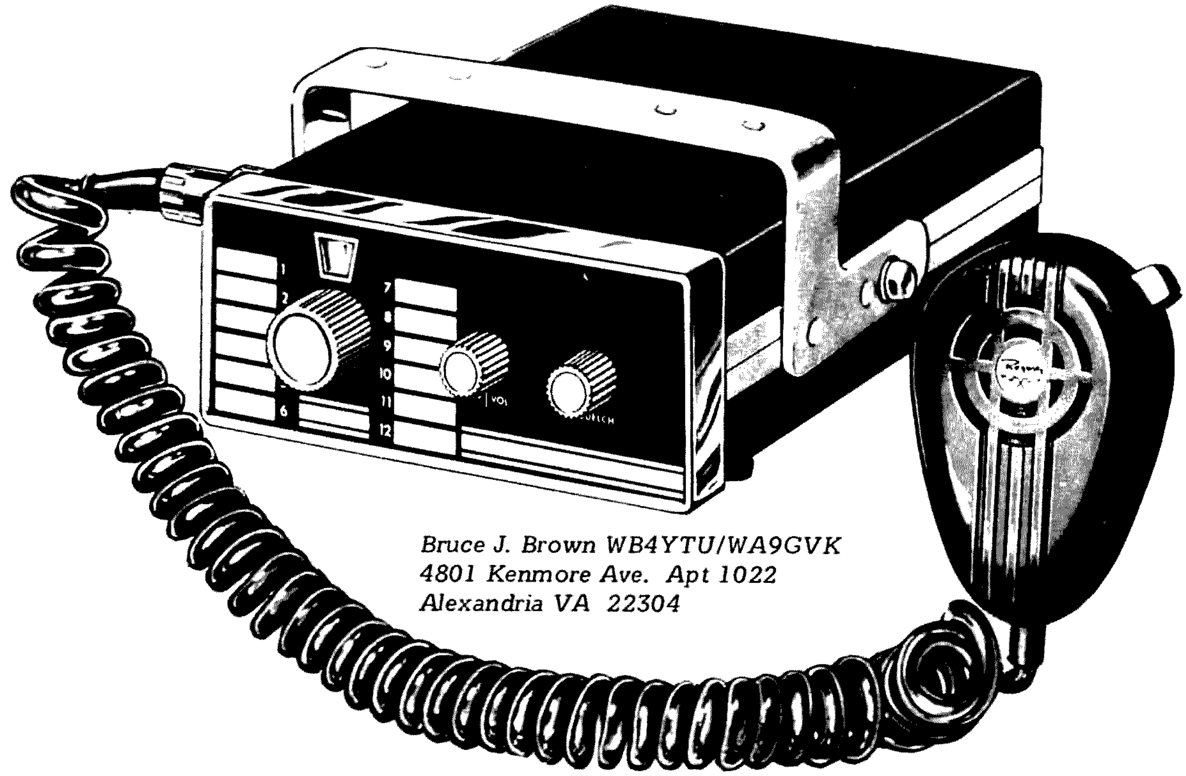
3) Get data sheets on ICs that you wish to work with. They have the circuit diagrams of the internal gates so you know how to hook them up. They also give 0 and 1 values.

4) Never be embarrassed to return non-working chips. The same mass production techniques which brought down the price also brought down the quality. Don't get worried, though: *Most* ICs *will* function properly, but if they don't, return them. I have *never* had a store *not* replace a non-working chip. Even the mail order houses exchange them without a hassle.

5) New breadboard kits have been arriving on the markets. I haven't tried them, but they look good.

6) ICs are rugged. Don't be afraid of them.

...WB2NEL



Bruce J. Brown WB4YTU/WA9GVK
4801 Kenmore Ave. Apt 1022
Alexandria VA 22304

Breakthrough in Fast Scan ATV

Are you tired of using your tube ATV rig as an auxiliary room heater? Is your rig taking up valuable space that could be better used for storage of your porno magazine collection? Does everyone think your rig looks like a booby prize won at a hamfest raffle? Are you tired of searching through surplus store garbage cans for final amplifier tubes? Have you been afraid to get into amateur television because of the above? If your answer to any or all of the above is yes, then the ATV Modified Regency HR-440 is for you!

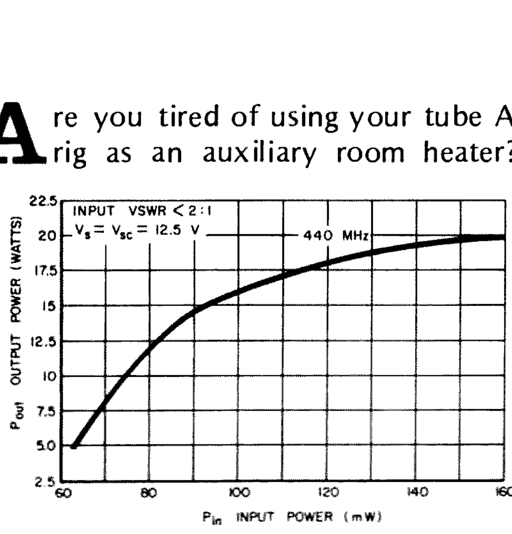


Fig. 1. MHW-710 output vs input power.

It is not only a compact, solid state, 10 Watt average TV transmitter, but has a

Required Test Equipment

1. UHF wattmeter (Bird 43) with 50 Ohm dummy load. (50 feet of RG-58 into a Heath Cantenna results in a good UHF load.)

2. 20,000 Ohms per volt (or greater) VOM.

Required Modification Tools

1. 30 Watt soldering iron and 60/40 solder.
2. Diagonal cutters.
3. Needlenose pliers.
4. Wirestrippers.
5. Screwdriver (to tighten #4-40 screws).
6. Jeweler's screwdriver.
7. Nutdriver set (Radio Shack 64-1800; $3.29).
8. Desoldering tool or remover wick (Radio Shack 64-2090; $1.49).
9. Variable speed electric drill with the following bits:
a. 3/32" (optional hole starter)
b. 1/4"
c. 3/8"
10. File (to clean burrs from holes).
11. 1/2" wrench (for tightening UG-1094 nuts).
12. RTV or nut-tightening solution.
13. Ruler.

Required Tune-Up Tools

1. 0.075 plastic hex alignment tool.
2. Thin tipped insulated screwdriver. Both available in single tool, GC #9304 ($.55).

Required Reference

Regency Owner's Manual Model HR-440 440 MHz Amateur FM Transceiver (supplied with rig; $5.00 otherwise). Regency Electronics, 7707 Records Street, Indianapolis IN 46226.

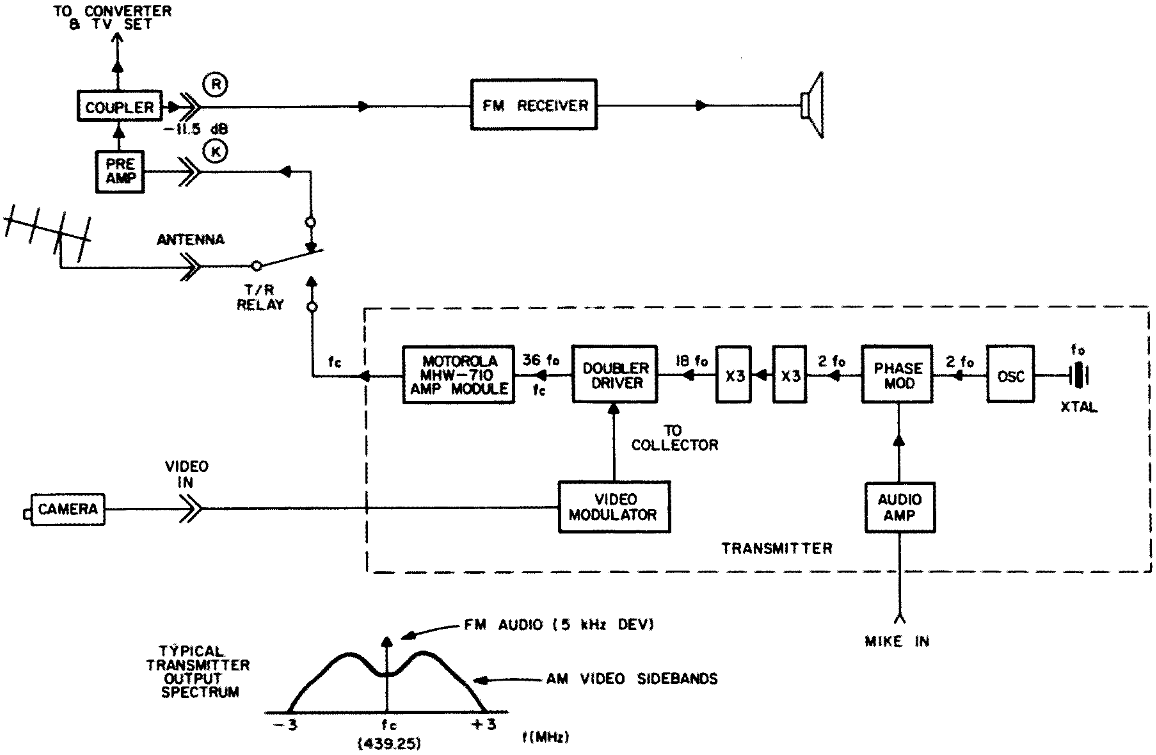


Fig. 2. HR-440 Mod ATV transceiver block diagram.

squelched audio receiver, to boot. It's adaptable for simplex and/or repeater operation and is compatible with the popular "audio on the video carrier" format. You can even operate ATV from your car or in the field with a rechargeable battery.

This paper details the modification procedure necessary to use an HR-440 for fast scan amateur television use. Approximately $25 in parts and 5 hours of labor, using proper tools, are required to implement the conversion.

Transmitter Modification (Figs. 1, 2 and 3)

Video amplitude modulation of the carrier is achieved through collector modulation of the driver stage immediately preceding the Motorola MHW-710 power amplifier module. This is accomplished using a video modulator board added internally in the rig. A somewhat linear output signal is possible due to the output vs. input performance characteristics of the module operating in the 7 to 10 Watt region as shown in Fig. 1.

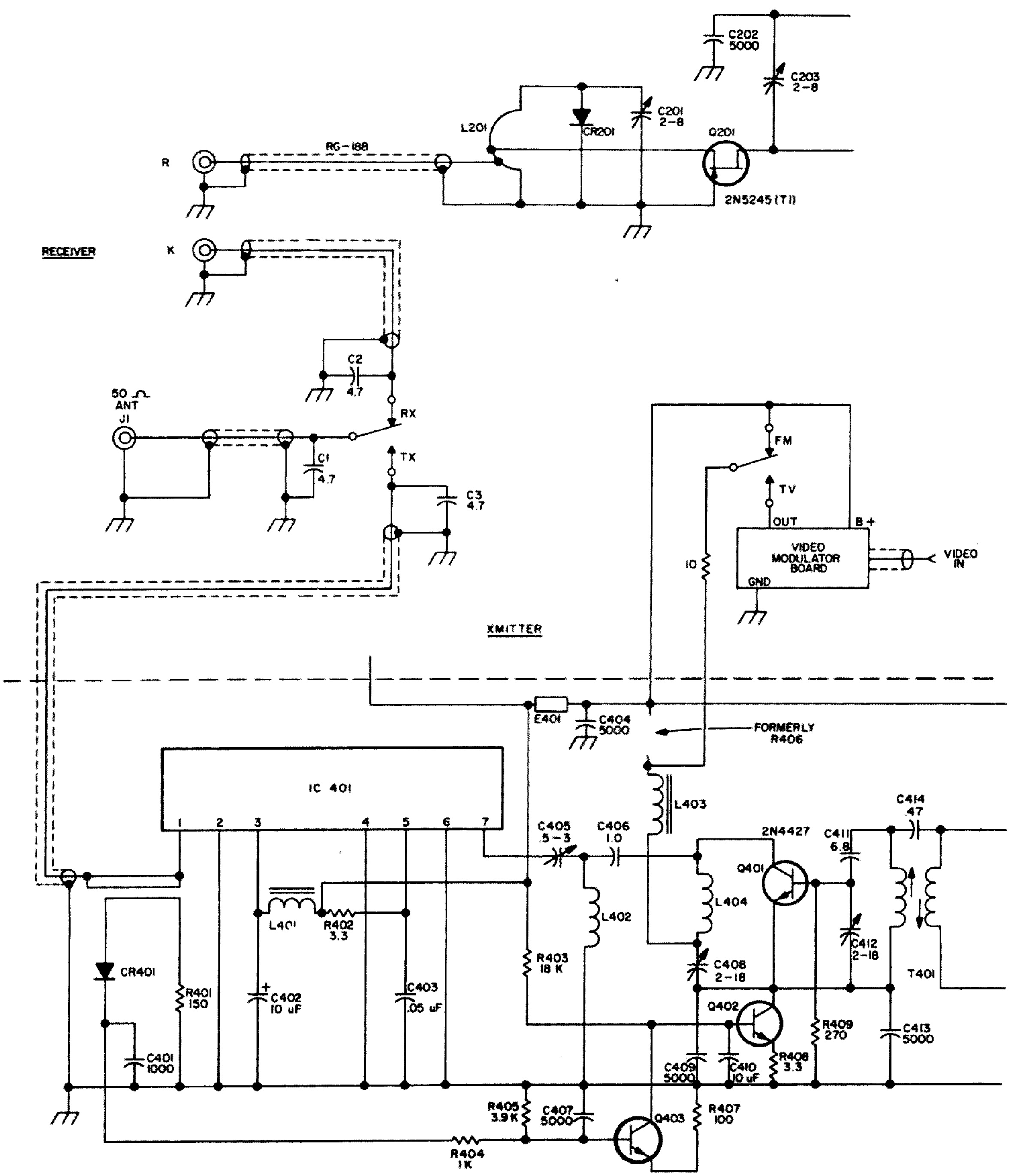


Fig. 3. Modification schematic.

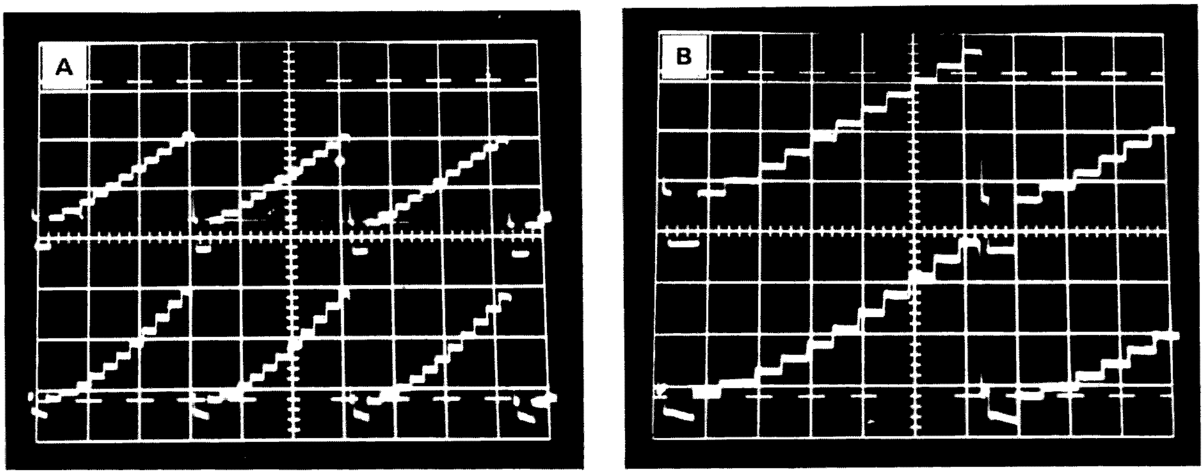


Fig. 4. Performance curves — linearity. (a) Top scale: video in .5 V/div.; bottom scale: detected rf out 10 mV/div.; axis = 0; 20 usec/div. horizontal; 10 Watts average out. (b) Top scale: video in uncalibrated; bottom scale: detected rf out uncalibrated; 10 usec/div. 10 Watts average out.

Although true linearity is not achieved, few, if any, will be able to detect the slight non-linearity when viewing the picture. Most noticeable, when observed on an oscilloscope display of the detected rf, will be compression of the sync tips (highest power levels). Again, this is not a problem since the majority of amateurs use compressed or clipped sync anyway to achieve a greater average power level from their transmitters. (Most TV sets are capable of locking up to a picture exhibiting very low sync pulse level.)

This modification scheme results in amplitude modulation of the carrier, for video, and frequency modulation of the same carrier, for audio. Since a TV receiver cannot receive both the picture and audio simultaneously unless the audio is located 4.5 MHz above the video carrier, a separate receiver tuned to the carrier must be employed to demodulate the audio from the 440. Such a receiver is available in the HR-440.

Receiver Modification (Figs. 2 and 3)

The HR-440 relay-to-receiver wiring is modified to permit the bulk of the received signal from the antenna to be routed ultimately to a TV receiver (via connector "K") for video display. Using an external coupler, a small portion of the signal is fed into the HR-440 receiver (via connector "R") to provide television audio.

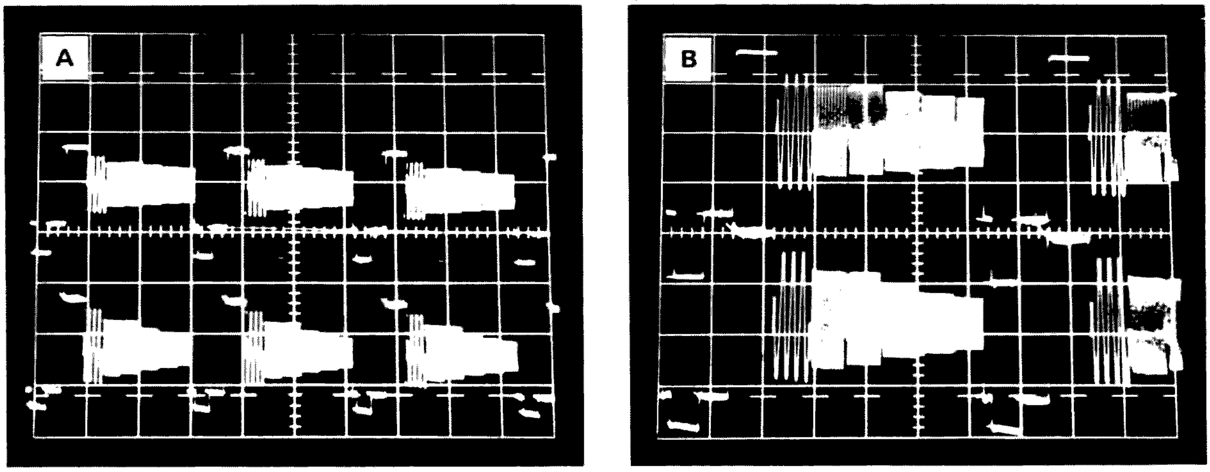


Fig. 5. Performance curves — frequency response. (a) Top scale: video in .5 V/div.; bottom scale: detected rf out 10 mV/div.; axis = 0; 20 usec/div. horizontal; 10 Watts average out; burst order (in MHz): .5, 1.5, 2.0, 3.0, 3.58, and 4.2. (b) Top scale: video in uncalibrated; bottom scale: detected rf out uncalibrated; 10 usec/div.; 10 Watts out average; burst order (in MHz): .5, 1.5, 2.0, 3.0, 3.58, and 4.2.

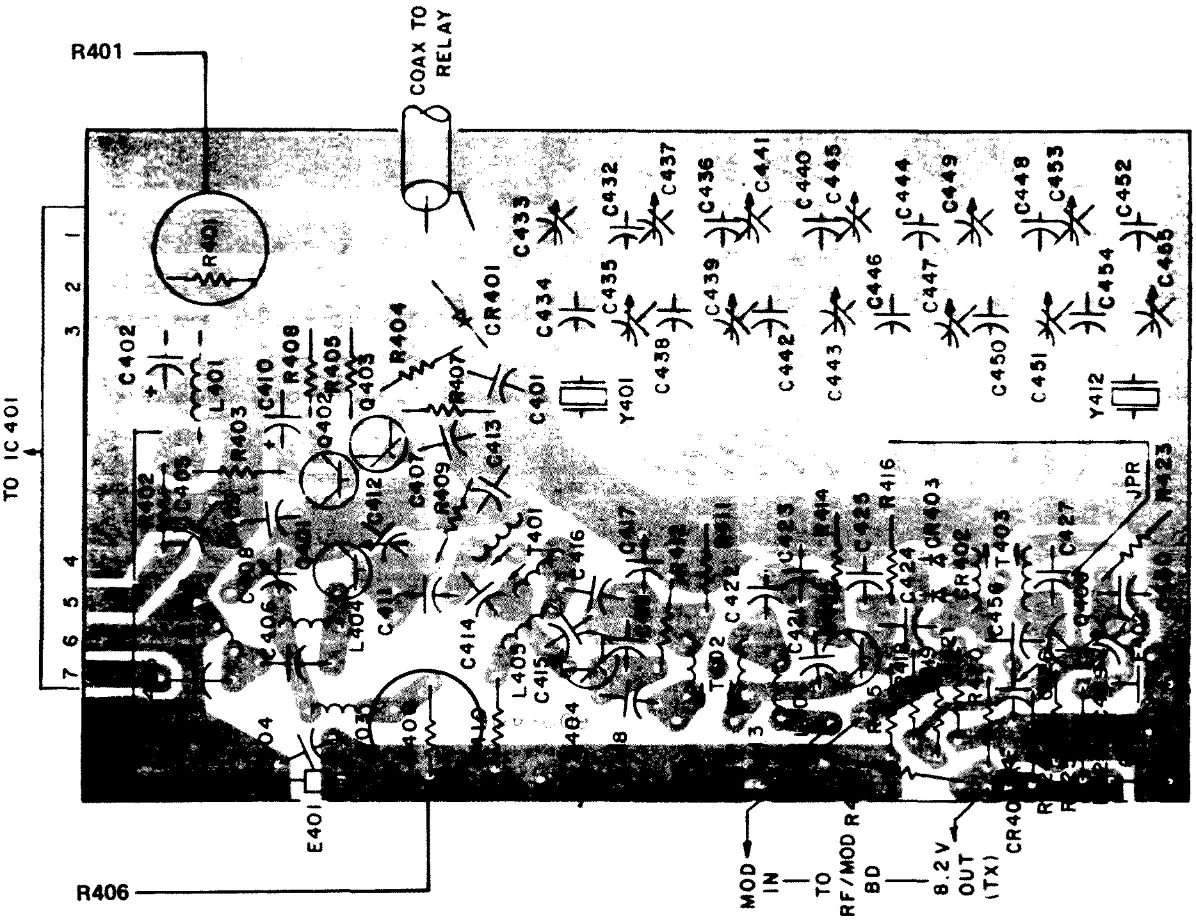


Fig. 6. Transmitter board 600-406, foil side.

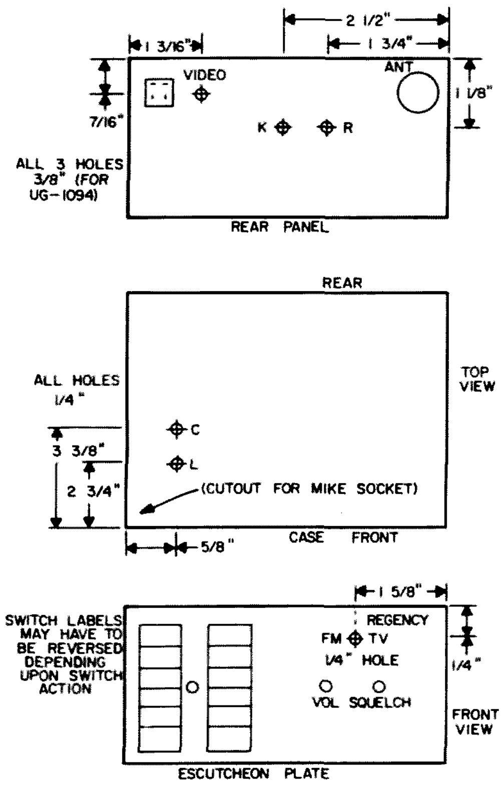


Fig. 7. Drill and label guides (not drawn to scale).

Modification Procedure

Before proceeding, make sure the rig is operating properly using the 446.0 MHz crystals supplied. Immediately order the crystals for amateur television operation in your local area. Delivery is approximately 1 month; see parts list.

1. Remove transceiver cover by unscrewing the two large bolts located at the sides.

2. To remove speaker, unscrew the two small metal screws (one on each side) holding the speaker bracket. Carefully place the speaker assembly along side of the unit.

3. Locate R401 on the transmitter board; see Fig. 6. Check its value. If it is 150 Ohms, as was installed in the first factory production run, replace it with an 82 Ohm, ¼ Watt resistor. This factory authorized modification desenses the Vswr limiting circuit to improve output power levels into slightly mismatched antenna systems. Re-install speaker.

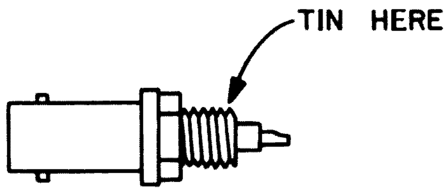


Fig. 8. Tinning UG-1094.

NOTE: THE WARRANTEE WILL BE VOID UPON IMPLEMENTING THE FOLLOWING MODIFICATION PROCEDURE.

4. Turn rig over so that foil side is facing you. Locate R406 (10 Ohms) on the transmitter board referring to Fig. 6. Using a soldering iron with a desoldering device, remove solder around both R406 leads. Alternately apply pressure to each lead using the soldering iron tip to release the resistor from the PC board. You can use a lead from a spare ¼ Watt resistor to help push the R406 leads through. SAVE R406. You will use it later. Make sure both holes are completely clear of solder.

Approximate Time, Steps 1-4 = ¼ hour

5. Using Fig. 7, very carefully drill three 3/8" holes in the rear chassis. A smaller drill size, such as 3/32", may be helpful to initially start the hole. When drilling, hold chassis securely and with foil side up to prevent metal particles from falling into the electronics. Clean burrs from holes with a file and apply labels "Video," "K" and "R" as shown in the figure.

6. Insert three UG-1094 connectors into the holes. Loosely mount them with the lockwashers and nuts supplied. Do not tighten. Tin, with a soldering iron and solder, a portion of the grounded edge of the UG-1094 "K" and "R" connectors. See Fig. 8.

It will probably take several minutes to develop enough heat to permit a good solder flow. (The tinning operation will permit RG-188 shields, described later, to be properly terminated to ground.) Tighten all three connectors with a ½" wrench, making sure that the tinned regions are facing up.

Approximate Time, Steps 5 and 6 = 1 hour

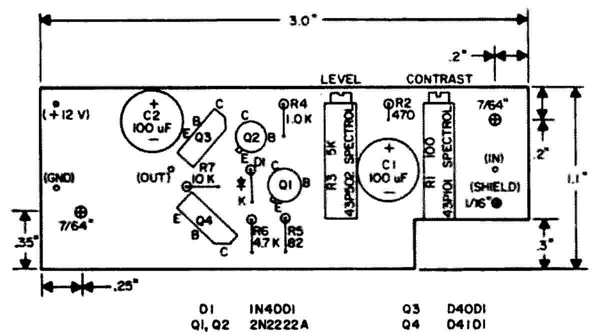


Fig. 9. Video modulator — component side. Tabs cut off of D40 and D41. Resistors and diode mounted vertically.

7. Mount all components to the video modulator PC board as shown in Fig. 9, noting the following:

a) Double-check polarities of the 100 uF capacitors, D40D1 and D41D1 transistors and the 1N4001 diode.

b) Seat both pots as close as possible to PC board.

c) Clip off tabs of D40 and D41 transistors.

d) The diode and all resistors are mounted vertically.

e) Keep leads short and solder globs small on the foil side of the board.

8. Add wires to the video modulator board as follows:

a) Strip ½" insulation of a 10" length of RG-188. Separate center conductor and shield. Strip 1/8" insulation from center conductor. Solder center conductor to "IN" on board and shield to adjacent ground hole.

b) Solder 8" of insulated #24 solid wire to "OUT."

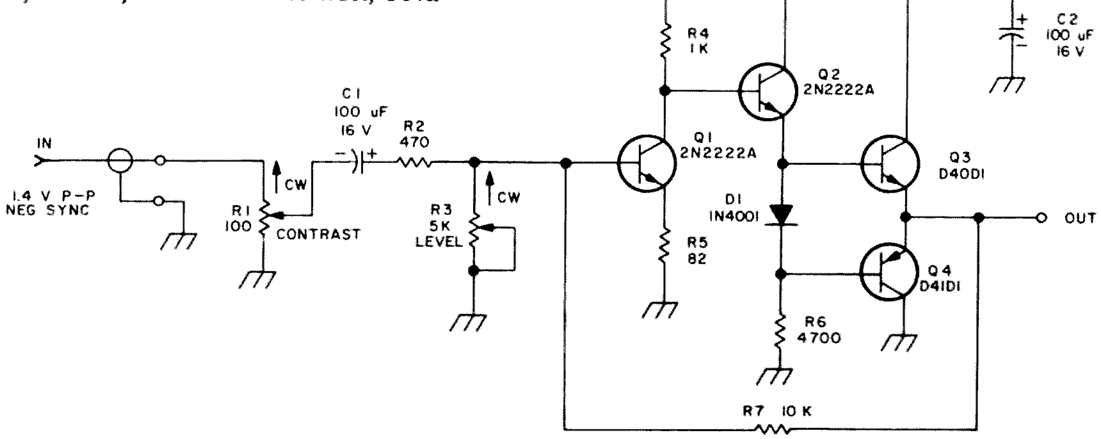
c) Solder 8" of insulated #24 solid wire to "B+".

d) Solder 1" of insulated #24 solid wire to ground hole provided near "B+" hole.

Approximate Time, Steps 7 and 8 = 1½ hours

9. Remove speaker. Mount the video modulator board inside the rig on the left side wall (with front of rig facing you), as shown in Fig. 12. Existing holes in the chassis wall are used. Use two ½" long flat head #4-40 screws, #4 spacers 1/8" long, lockwashers and nuts. Video modulator board foil faces the chassis wall; pot adjustments facing up. Put a dab of RTV (or

Fig. 10. Regency HR-440 Video Modulator (similar in structure to WØMZL T44 modulator described in QST, Feb 73). All resistors ¼ Watt, 10%.



similar solution) on the nuts after they are tightened to prevent them from loosening and falling into the rig under severe vibration.

10. Connect the RG-188 cable from the video modulator board to the "Video" BNC connector on the rear. Shield is soldered to the ground of the adjacent power connector. Route cable along the side and rear walls.

11. Solder the 1" wire from the video modulator board (ground) to the grounded terminal of the nearby microphone connector.

Approximate Time, Steps 9, 10 and 11 = ¼ hour

12. In order to mount the front panel mode selector switch, pull off the three knobs on the front panel. Using a jeweler's screwdriver, pry off black escutcheon plate which is glued to the chrome-plated bezel. As shown in Fig. 7, drill a ¼" hole and mount a miniature SPDT toggle switch.

13. Route wire from "OUT" on video modulator board along the upper, inside edge of the front wall. Direct the wire-end through the hole located above and between the volume and squelch pots so that it protrudes through the front of the rig. Place a ½" piece of spaghetti over this wire and solder it to the miniature switch as shown in Fig. 12. Push spaghetti over contact.

14. Solder one end of a 10 Ohm resistor, namely R406 removed in Step 4, to the center terminal of the switch. Solder the other end to a 4" piece of insulated #24 wire. Use a large piece of spaghetti to completely cover the resistor and solder joints. The other end of the wire is soldered to the plated-through hole in the transmitter board, formerly occupied by R406, that is electrically connected to L403. It is the hole furthest away from the wall. See Figs. 6 and 12. The resistor and wire should also have

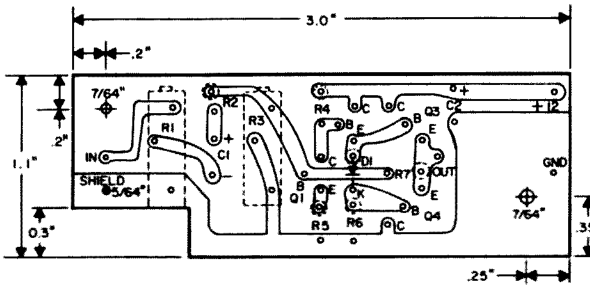
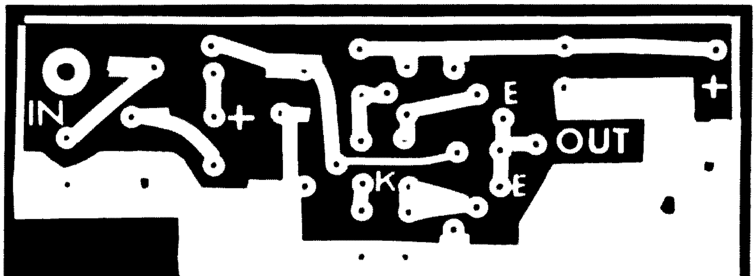


Fig. 11. Video modulator — foil side. Board available from Stu Mitchell WAØDYJ. See parts list.



been routed through the same front panel hole described in Step 13.

15. Solder one end of a 4" insulated #24 solid wire to the remaining R406 hole (B+) and route it along with the wire from "B+" on the video modulator board through the front panel hole described in Step 13. Slip a piece of spaghetti over both wires and solder to the remaining contact on the switch.

16. Replace front panel escutcheon plate onto the chrome-plated bezel and replace all knobs. Use a VOM as a continuity tester to determine the switch position which shorts the center switch contact to "OUT" on the video modulator board. Label this position "TV" on the front plate and the other position "FM".

Approximate Time, Steps 12 through 16 = 3/4 hour

17. Using a solder removal device, remove the center conductor and shield of the white coax cable terminated on the receiver board near the antenna connector. Do not unsolder this cable at the relay end. Re-solder this cable to the BNC connector "K" installed in Step 6. Solder the shield to the tinned portion of the BNC. You may have to keep the soldering iron touching the connector for a considerable period to develop enough heat to solder the shield.

18. Connect a 3" length of RG-188 between the receiver board holes emptied by Step 17 and BNC connector "R" installed in Step 6. Connect shield as described in Step 17.

19. Bend both speaker terminals 90 degrees inward using needlenose pliers (to provide sufficient clearance for video modulator board components after the speaker is mounted).

20. Drill two ¼" holes on top of the case and label as shown in Fig. 7.

21. Carefully loosen relay by removing two screws on chassis side. Completely wrap relay in copper foil and ground to relay support bar. Re-install screws and secure relay in original position.

Approximate Time, Steps 17 through 21 = 1¼ hours. Except for final tune-up, the modification is complete. Total Approximate Time = 5 hours

22. Follow procedure in the tune-up section.

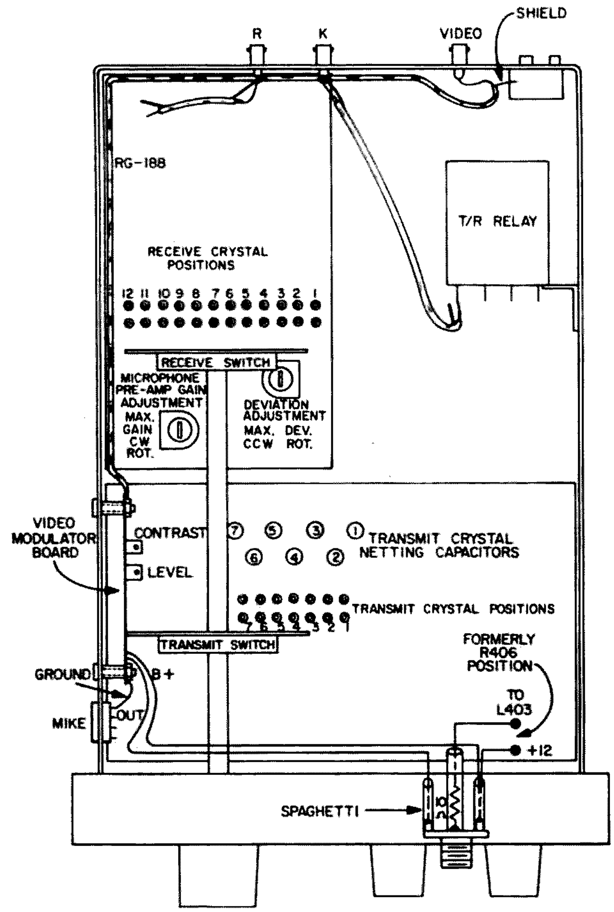


Fig. 12. Modification components layout — top view.

23. Re-install speaker. The large cut-off end is adjacent to the relay.

24. Re-install case on rig.

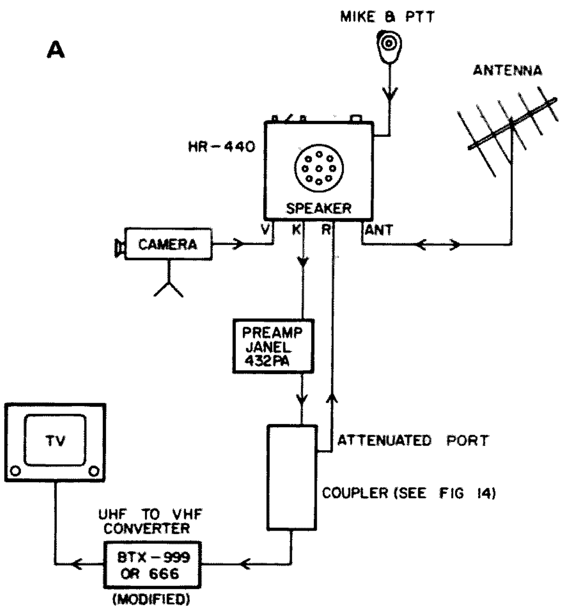
Tune-Up Procedure

Install crystals for television frequencies in your local area (typically 439.25 MHz transmit, 439.25 MHz simplex receive, and 427.25 MHz repeater receive). Follow installation instructions detailed on page 9 of the HR-440 Owner's Manual.

A. Transmitter

1. Retune transmitter as described on pages 12 and 13 of the Owner's Manual using a UHF wattmeter with dummy load. A 20,000 Ohms/volt VOM may be used in lieu of the VTVM specified. IMPORTANT: Both leads of the VOM or VTVM must be floating with respect to ground. The front panel mode switch should be in the "FM" position for this initial tune-up.

2. Set the "C" or contrast control (accessible from the top of the case) fully *counter*clockwise (CCW).



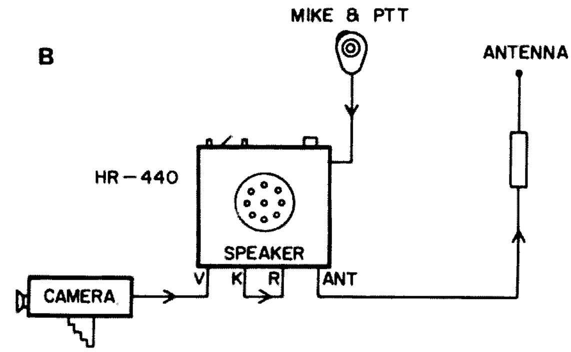


Fig. 13. Operational configurations. (a) Home use — video and audio transmit; video and audio receive. (b) Mobile/field use — video and audio transmit; audio receive.

3. Set the "L" or power level control fully clockwise (CW).

4. Set the mode selector switch on the front panel to the "TV" position. The rig should now operate as it did in the "FM" position (or as it did before modification); i.e., about 15 Watts out from a cold start *into a matched 50 Ohm load.*

5. Connect the video output of a TV camera producing a 0.5 to 2.0 volt peak-to-peak signal to the "Video" connector on the back of the rig.

6. Using the wattmeter, turn the "L" control *counter*clockwise (CCW) until 10 Watts is read. IMPORTANT: 10 Watts is possible only when a properly matched antenna system is used.

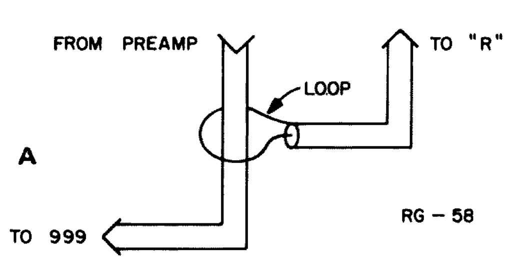
7. Viewing the picture on a converted TV set, turn the contrast control "C" clockwise (CW) until a picture starts to appear on the screen. Recheck the output power and if necessary readjust "L" for 10 Watts. Keep turning "C" clockwise until a good picture appears. Readjust "L" for 10 Watts.

8. Re-peak C405, C408, C412 and the top of T401 for maximum output power. Set C408 slightly *counter*clockwise (CCW) past its peak and the top core of T401 slightly clockwise (CW) past its peak.

9. Repeat Step 7 if necessary.

10. Once on the air, using an antenna with a through-line wattmeter and a remote receiving station to watch your picture, the rig can be properly fine-tuned to provide an excellent quality picture. NOTE: Do not set "C" too high or you will cause cut-off or buzzing on the audio channel.

B. Receiver — Follow procedure on page 11 of the Owner's Manual with the signal generator connected to "R" on the rig.



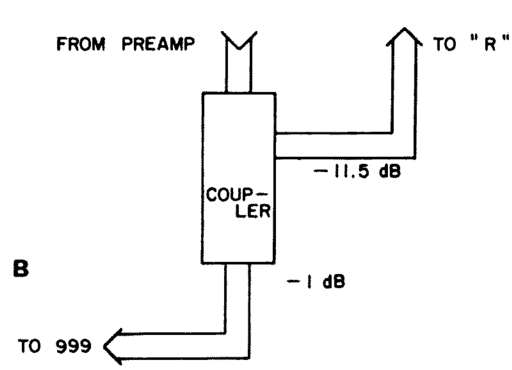


Fig. 14. Coupler implementation. Method (a) — simple, inexpensive; results in large drop of audio receiver (HR-440) sensitivity but is adequate for most applications. Method (b) — more expensive but provides greater audio channel sensitivity. Low cost coupler available from Minicircuits Lab, 837-843 Utica Ave., Brooklyn NY 11203, 212-342-2500. #PDC10-1, $11.95 (qty 5-49), does not come with connectors but could fit into Janel Pre-amp; or #ZDC10-1, $26.95 (qty 4-24), with BNC connectors in case.

PARTS LIST					
Part #	Description	Qty.	Unit Cost	Total Cost	Source of Supply
1	439.25 HR-440 xmit xtal 439.25 HR-440 rcv xtal 427.25 HR-440 rcv xtal (for TV repeater reception)	1 1 1		6.50 4.95 4.95	Shepherd Industries P.O. Box 4279 Overland Park KS 66204 $15 min. order; Delivery about 30 days. Prices are postpaid.
2	UG-1094 BNC Bulkhead connect	3	1.10	3.30	Numerous
3	Subminiature SPDT Toggle Sw 7/32 or 1/4" mounting hole	1		1.39	Radio Shack 275-613 or equal
4	Dry transfer or stick-on lettering kit				
5	#24 solid insulated wire	30"			
6	Spaghetti; 1/8" OD	3"			
7	1/2" long #4-40 flathead screws. Head length not greater than 1/16". File down if necessary.	2			
8	4-40 nuts	2			
9	#4 lockwashers	2			
10	#4 hole, 1/8" long spacer, metal or plastic	2			
11	RG-188 cable	13"		Cable &	Stu Mitchell WAØDYJ/4 14761 Dodson
12	Video Modulator PC board, etched, cut and drilled	1		Board $3.00	Woodbridge VA 22193 Postpaid
D1	1N4001 Diode	1		.09	
R1	100 Ohm pot #43P101 Spectrol	1		1.35	James Electronics
R2	470 Ohm, ¼ Watt, 10%	1		.05	P.O. Box 822
R3	5k pot, #43P502 Spectrol	1		1.35	Belmont CA 94002
R4	1.0k, ¼ Watt, 10%	1		.05	(415) 592-8097
R5	82 Ohm, ¼ Watt, 10%	1		.05	Add 5% for postage &
R6	4.7k, ¼ Watt, 10%	1		.05	handling; 8 day delivery
R7	10k, ¼ Watt, 10%	1		.05	$5.00 min. order.
C1, 2	100 uF, 16 V dc Radial	2	.19	.38	
Q1, 2	2N2222A	2	.20	.40	
Q3	D40D1, D40D4 or D40D7 (GE)	1		1.00 approx.	Schweber (Nationwide) or Spectronics, 1009
Q4	D41D1, D41D4, or D41D7 (GE)	1		1.00 approx.	Garfield St., Oak Park Illinois 60304 ($2.35 ppd for D41D7 & D40D7)
	BNC Male to BNC Male 4 to 12" (for recvr hookup)	1		4.85	Pomona or equal
	Copper Foil, Circuit Stik #9252	1 sheet		1.29	

Acknowledgements

The author is grateful to Metrovision Amateur Television Club for purchasing the HR-440 used to develop this modification procedure. Terry Fox WB4JFI provided valuable test equipment to optimize the modification design and Tom Ohara W6ORG provided useful comments concerning the MHW-710 power module. The video modulator printed circuit board was fabricated by Stu Mitchell WAØDYJ/4.

. . . WB4YTU/WA9GVK

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Strobing Displays is Cool

Well, I'd managed to build my own home brew frequency meter, mostly from the K5DUS article in the March, 1973 issue of *73,* only to discover that the most lightly covered subject, the regulated power supply, was insufficient to power *my* version of the instrument. I not only had ac hum on the Vcc line, but I had little samples of everything that was going on inside the timing circuits also appearing on the +5 volt "regulated" Vcc line. As everybody knows (but doesn't take into account), transistor devices are current eating little monsters and must be fed properly or else! Something in there was using up mils like mad.

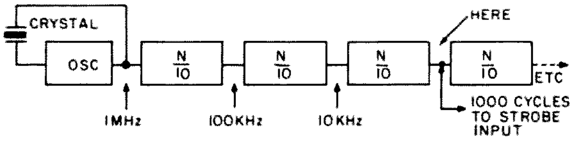

Fig. 1. All n/10 = 7490.

I checked the Vcc line with my voltmeter and sure enough, the regulated Vcc lines were down to about 4.6 volts and "hairy," even though I had split up the loads between two LM309 IC voltage regulators (which should each have handled a full Amp). In fact, the LMs were so hot you could fry eggs on the heat sink. The thing was drawing upwards of three Amps and the LEDs were doing the worst drawing.

Having recently been involved in trying to solve a problem with an IC digital clock, I remembered the unique way that the clock displays were strobed to decode the numerals into only seven lines. Strobing is just another way of saying that the power was being applied to first one segment and then another, so fast that the eye couldn't detect the flicker. This also resulted in power being applied to only one segment at a time, and the power supply was never "seeing" more than about a 20 mA load at any time. Wonderful!

Before I could work it all out (I'm a slow thinker), W5NPD's article appeared in the July, 1975 *Ham Radio* about multiplexing (strobing) LED surplus calculator displays for ham use. These multi-digit, one piece LED displays are out of those little hand held calculators which have become so plentiful and are absolutely useless unless they *are* strobed.

Anyway, this saved me a lot of trouble trying to design something new. I would strobe the display anodes and reduce the amount of power they used to about a sixth and still have adequate brightness. It would also save me from re-engineering the whole power supply, which I had neatly tucked into the leftover space at the back of the cabinet.

We start with 1000 Hz borrowed from the timing chain. If you are using a 1 MHz crystal for your standard, the takeoff point would be at the output of the third 7490 IC from the 1 MHz oscillator. See Fig. 1. From this point the 1 kHz goes into the strobe circuit and into the 7492 divide-by-twelve countdown IC. In W5NPD's schematic he used a 7490 divide-by-ten IC, which gives a scan frequency of 100 Hz, but I figured that by going to the 7492 I would get about 83.3 Hz scan (which gives a longer duty cycle with consequent brighter display). The binary output of the 7492 is then presented to a 7441 IC, which converts it to a one-in-ten output. The 7441 was designed to drive numeral elements in a Nixie tube by grounding whichever element it wanted to light up. Very nice! Since the IC couldn't handle the current being used by the LED displays, we use a cheap pass transistor to do the dirty work. All that is needed is a 5600 Ohm "pull up" resistor on each of the ten output leads and a 470 Ohm resistor to limit base current. Ha! Now we're getting somewhere! See Fig. 2.

In order to get the highest brightness to the displays, I hooked the pass transistor Vcc line to the power supply right where the rectified dc goes into the first filter capacitor. There's a high 120 Hz ripple there (as might be expected), but there are also about 8 volts pulsating dc (and the LEDs aren't bothered a bit by that).

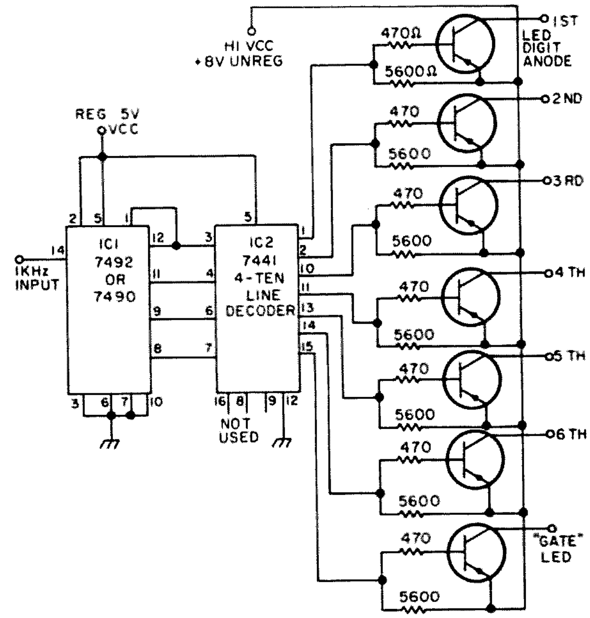

Fig. 2. All transistors are 2N3904 PNP. All resistors are ¼ Watt.

I built the strobe circuitry on a plug-in card and eased it into a spare slot which I had provided to cover Murphy's Law on homebuilt equipment.

I then removed the jumper wire which connected all the display anodes and brought a wire from each anode in turn to one of the pass transistor leads. I included a separate wire for the little LED that shows the gate is "open". This used up seven of the possible ten outputs and left three "spares" in case something else turned up.

Back into the socket went the old line cord and again I checked the Vcc lines. This time the Vcc lines were pure. I was getting a good solid 5 volts on each of the VRs and the strobe circuitry was drawing only about 90 mils. The power supply assembly fit nicely back into the rear of the case with the heat sink only mildly warm to the touch.

At 83.3 Hz/sec the display appears solidly lit to the eye and the count is not a bit affected by what is being used to power the displays.

I've since wondered whether I couldn't have put the whole thing, more or less, on a synchronized strobe and reduced the power consumption even more, but that would mean more brain work — and everybody knows that hams like to do things the easy way. Any ideas, anyone?

. . . WB4DCV

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The Sensuous Tuned Lunch Box

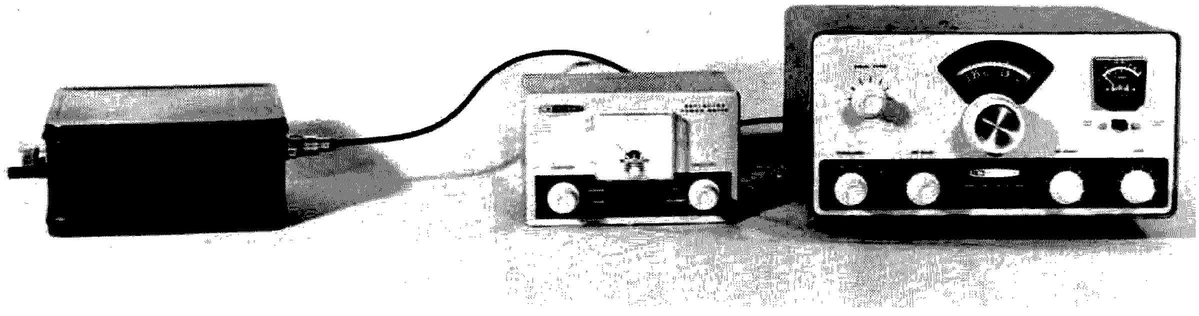
End-fed antennas seem to have lost their popularity about the time coax came into ready supply in the ham world. The reasons are quite obvious: A center-fed dipole is easy to match with coax, you don't have rf floating all around your shack, and finally, most of today's transmitters have low impedance output. From the standpoint of convenience, however, they are hard to beat, especially when you take your rig with you on vacation.

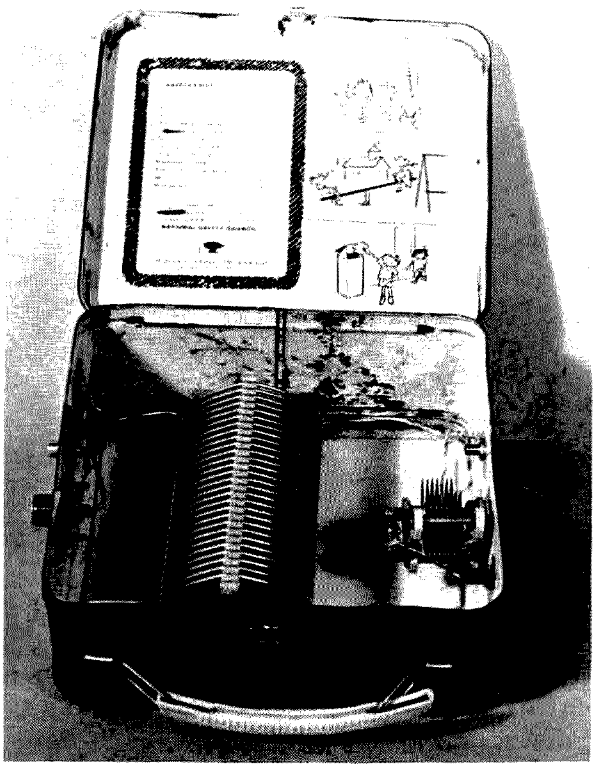
As I mentioned, most transmitters have a low impedance output. The end of a half wave antenna is very high in impedance. Consequently, if an end-fed antenna is to be used, some kind of impedance-transforming device is needed – hence the antenna tuner.

I picked up the lunch box for 50¢ at the local junk shop. The rest of the parts came either from my junk box or from the trash can at work. For the ham without the convenient access to discarded electronic goodies that I enjoy, the inductor would probably be the most expensive component, and even that is no big deal.

The circuit used is called an "L-network," and is a favorite wherever a low-to-high impedance transformation is used. Perhaps it is over-simplification, but I find it easiest to understand by rearranging it to look like the classical parallel-tuned circuit with the signal source in series. A parallel-tuned circuit, which is what the antenna sees, is a high impedance device. On the other hand, circulating currents within the circuit are quite high, and very little voltage exists between the "low" end of the coil and ground. Low voltage and high current defines a low impedance. Thus the transmitter sees a low impedance load.

The latch and handle were taken off the box long enough to paint it. If you want a "cool" looking tuner, leave the original design intact. After drilling the mounting holes for the connectors, strip the paint from around each hole on the inside of the box to provide a good ground connection. Just to be on the safe side, I ran a wire to join the ground points of all parts. You might not want to do that.





Note that there are two input connectors. Heath transmitters often use an RCA phono connector for the antenna, while most others use the SO-239. Banana jacks receive the end of the antenna wire, and a lead to an external ground, if needed.

You will need a reflected-power indicator to tune it up. Generally speaking, the point of maximum forward power does not correspond exactly with the point of minimum swr. You want the lowest possible swr, because it is only in that condition that such things as low-pass filters work exactly as designed.

Tuning up this thing for the first time can be a headache, but it need not be. Troubles come only if you are working with more than one variable. However, if you know the approximate setting where your transmitter matches into fifty Ohms, set it there and leave it alone while you work with the tuner. With the antenna in place, set your station to the receive mode and tune the capacitor for maximum receive sensitivity. If your tuner seems to approach but not pass that point, you may need to change the inductance. Remove turns if it approaches peak at minimum C; add turns if it approaches peak at maximum C. This operation gets you into the right ball park. No change of inductance was needed in my unit. Now key your transmitter with reduced drive, and tune for maximum forward power. (CAUTION: Do this with your transmitter drive reduced to give about 50% of its normal output.) Next switch your reflected power meter to read swr and adjust the tuner for a dip in swr. Now you're ready to set your transmitter for full output and fine-adjust the tuner if necessary.

Once tuned up, you will find you have an almost immeasurably small swr. The tuner has a fairly wide tolerance to small changes in frequency. For larger changes, simply readjust for minimum swr. Experience with this type of tuner indicates that the needed inductance is inversely proportional to fre-

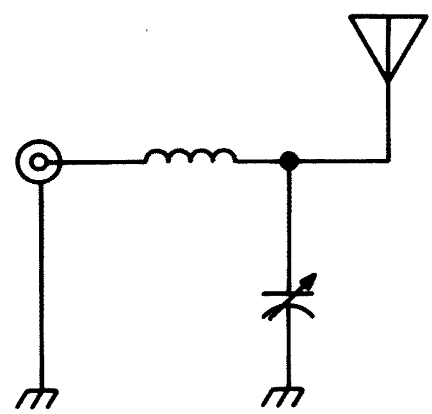


Fig. 1(a). The basic L-network.

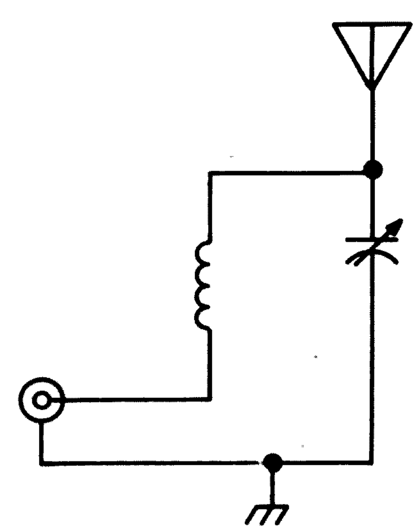


Fig. 1(b). Rearranging (a), we see the antenna at the top of a parallel-tuned circuit, while the transmitter output is in series with the circuit components, therefore seeing a low impedance.

quency, with about 123 feet of antenna. Although I didn't do it in this particular tuner, I have, in other tuners using the same circuit, operated multiband by simply tapping the coil. You may need to experiment a bit, but if you tap it about midway for 40 meters, 25% from the input end for 20, and about 16% from the input end for 15, very satisfactory swr can be achieved using an 80 meter half wave antenna. It simply becomes full wave on 40, a 2 wave longwire on 20, and a 3 wave longwire on 15, all of which have similar end-feed impedance.

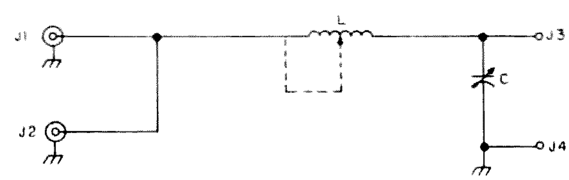


Fig. 2. The lunch box schematic (see Parts List for component values).

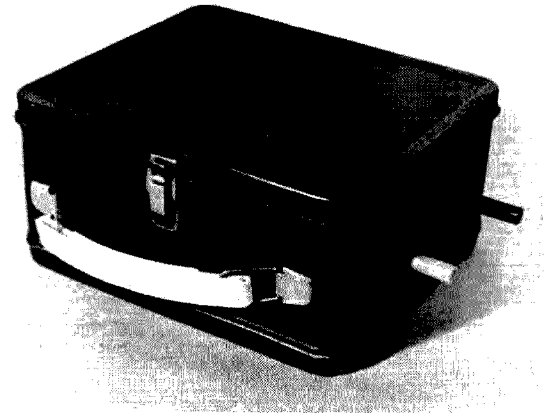
For those who may doubt that this thing works, it was fired up on 75 phone at 9:15 am, August 10, 1975. The transmitter was a Heath SB401. Signal report was S9+ in Cleveland, about 200 miles away. Swr was measured at 1.15 to 1 into a 125 foot wire. Later that day, when I checked into the Western New York Emergency Net, with the lunch box still in the system, I was reported as having "one of the best signals you've ever put into the net."

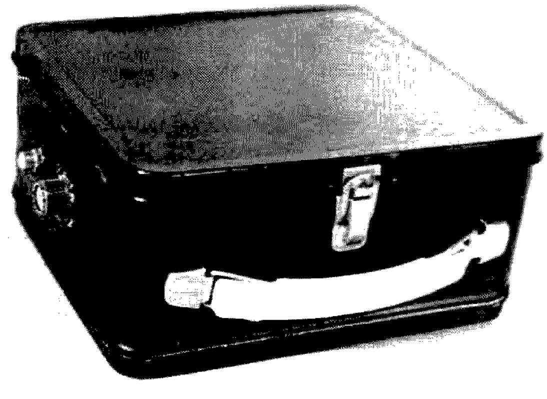
Parts List

J1 – SO-239
J2 – RCA phono connector
J3, J4 – Single banana jacks
C – 100 pF air variable
L – 80m: 27 mH B&W 3059, or equivalent; 40m: 13 mH B&W 3053, or equivalent; 20m: 6 mH B&W 3052, or equivalent; 15m: 4 mH B&W 3048, minus 3 turns; 10m: Experiment!

Above values are for half wave antennas. By tapping off turns in the 80 meter unit, you can feed an 80 meter antenna on 40, 20 and 15 with an excellent swr. Power limits depend mostly on wire size in the coil and plate spacing in the capacitor. This unit should be OK up to 400 Watts or so. For higher power, use a bread box and make your coil from a B&W 3064.

. . . W2FEZ





Bill Brown WØSYK
28 Marine Lane
Hazelwood MO 63042

Loudest Signal in the World?

The Saga of the Brown Bomber.

After many years of viewing the ads of Telrex Laboratories, showing their "Big Bertha," I finally got to see one in the flesh. In 1963 I visited Dr. Megebow K2HLB and enjoyed operating his station to his stacked yagis. Since I was of modest means, this antenna system was far from my reach. Seven years later, after the death of K2HLB, this antenna system was purchased and delivered to Memphis, Tennessee.

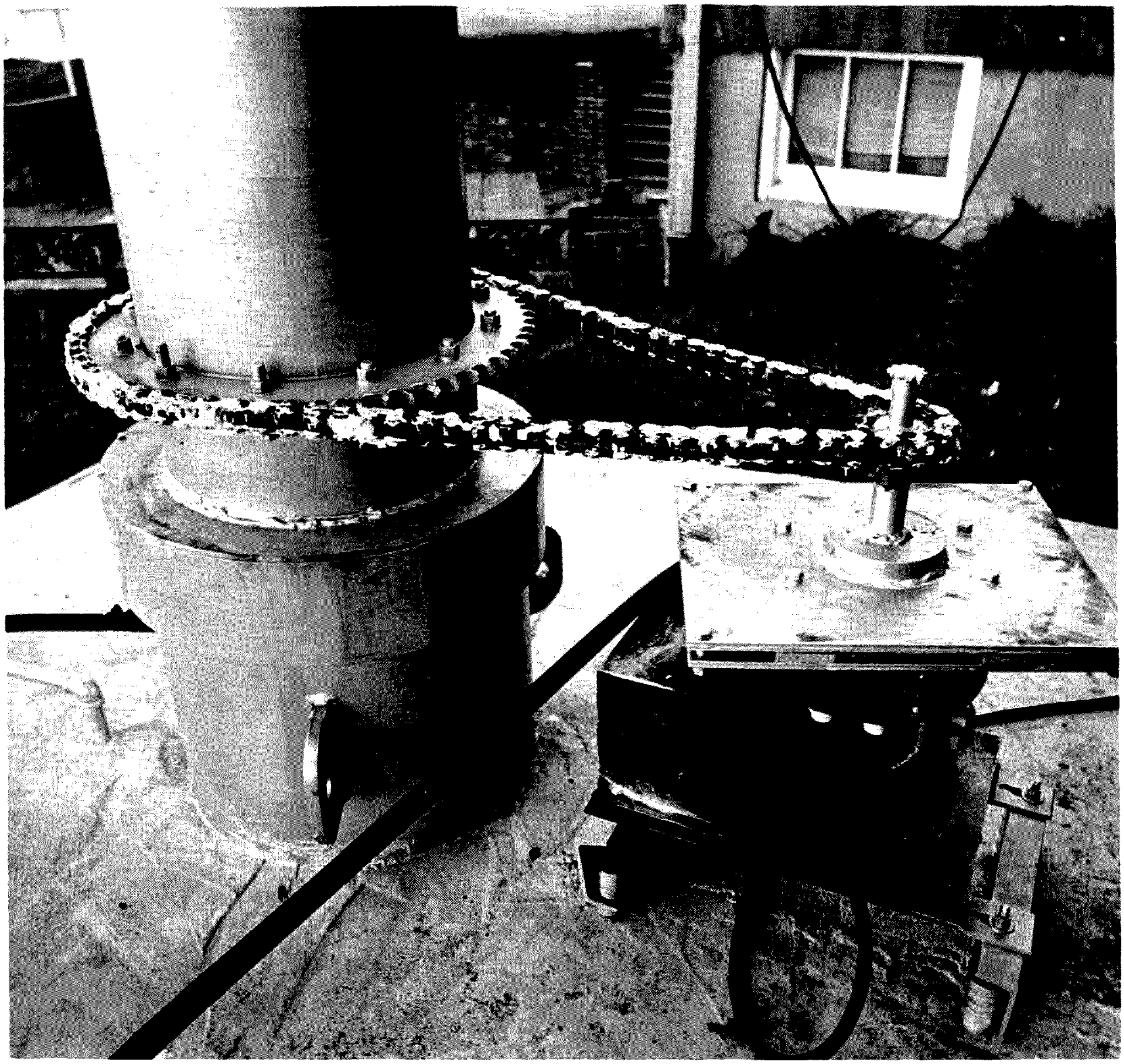
Before the erection of this mast (with the 4 sections on the ground and with the permission of the owner), I checked the size of the pipes as to wall thickness, length and diameter size. I found out that all pipes were of regular wall thickness starting with a #2 and increasing to the bottom section of 14", which is a #14 pipe.

I started getting prices and soon ordered the top two sections, which are 2-7/8" and 3-1/2" outside diameter. At this point I had less than $10.00 invested, but I was on my way. My next step was to purchase a Lincoln 225 A ac welder. The complete outfit sells for $99.00. Not being a welder, it took me a week or two to pick up this skill. Using the new drag rods, nice looking welds can be made by the novice welder. After welding the first two sections together, I purchased 3 more pieces to make up the first section. They were of 3-1/2" std, 4" std and 5" o.d., all of .250" (approx.) wall thickness common black steel pipe.

My garage is 25' x 40', so sections were welded up less than 40' in length. The first section was 26' and its total weight was 310 pounds.

After these five pieces were welded and painted, they were laid aside and progress started on section two. Total cost at this point was $43.00, which, divided by 26 feet, equals $1.65 per foot. Section two was made up of four pieces (5" std, 6" std, 7" std, and 8" std). All were .3125" wall thickness; total length was 29', with total weight about 800 pounds. Concrete blocks were used as horses to support the pipe during the welding operation. Up to this point no mechanical means had been used to raise and lower the pipes as all the sections weighed less than 200 pounds.

The third section, 34' in length, was made of 4 pieces which were 9", 10", 11", and 12" std. A 5 ton hydraulic jack was used to



engage these sections together, as well as was a 16' long 4 x 4, used as a lever.

Section four was made of one 40 foot long piece of 14" o.d. pipe (.375" wall thickness). This section weighed 2137 pounds, but was easily raised and lowered with the 5 ton jack. To keep the pipe sections concentric, steel spacers 1/2" wide, spot-welded at 120 degrees, did the job. These pieces were ground down on a grinding wheel to a clearance of .010". Overlap between pipe sections varied from 14" at the top to 24" at the bottom of mast.

Climbing steps were made from 3/4" steel rod 7" long, threaded on one end to screw into a 3/4" nut which was welded to the mast. Eight boom mounting plates were welded at the following levels above the ground: 41', 47', 53', 65', 85', 96', 103', and 110'. The total length of the mast was 127', of which 10 feet is below the ground. The top mounting plate is 7' below the top of the mast, for a boom strut for larger beams.

After the location for the mast was determined, concrete forms were erected and leveled, forming a square 7' x 7'. Hand digging was then begun and continued to a depth of 11'. This was done a little at a time and, after a depth of 7' was reached, dirt was hauled out with the help of five gallon buckets.

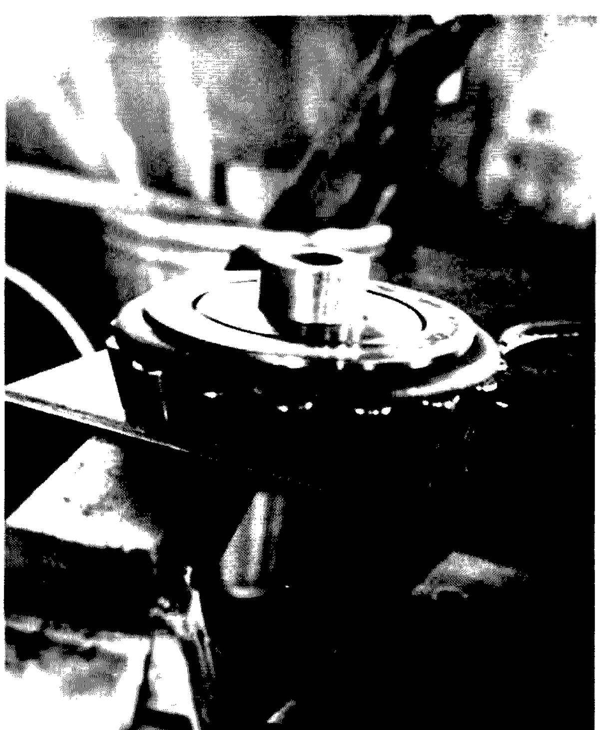
A 12' section of 18" pipe (with a wall thickness of .500") was used for the concrete tube. At the bottom end of this tube, a steel plate 36" x 36" was welded, to keep the tube plumb in the concrete. Before welding the tube to the plate, a bearing race was held in place by using 3 angle clips 120

1 pc 2-7/8" o.d. tubing 5/16" wall x 5' 2"	$ 4.78	
1 pc 3-1/2" o.d. tubing 5/16" wall x 4' 11"	5.08	
1 pc 3-1/2" std .226" wall x 7' 2"	7.80	
1 pc 4" std .237" wall x 7' 10"	10.19	
1 pc 5" o.d. .300" wall x 8' 0"	16.50	
1 pc 5" std .258" wall x 8' 2"	16.18	
1 pc 6" std .280" wall x 8' 0"	19.80	
1 pc 7" std .301" wall x 9' 1"	29.10	
1 pc 8" std .375" wall 11' 0"	38.40	
1 pc 9" std .312" wall x 10' 0"	46.80	
1 pc 10" std .307" wall x 10' 0"	48.20	
1 pc 11" (11.750" o.d.) .400" wall x 10' 0"	85.40	
1 pc 12" std .330" wall x 10' 0"	63.10	
1 pc 14" std 375" wall x 40' 0"	399.36	
1 pc 18" o.d. .500" wall x 11' 6"	213.93	
	$1,004.62	$1,004.62
Concrete 7' x 7' x 11' (19 yards)	$ 301.00	
Mach. work (tubing)	60.00	
Misc. steel	75.00	
Paint (3 coats)	20.00	
1 PKSE60 & 1 PKSE10 Boston Gear Sprockets	36.70	
2 side bearings (stock from 17" o.d. x 1.5000" wall)	60.20	
Mach. work	25.00	
1 rain shield	20.00	
	$597.90	597.90
		$1,602.52

Table 1. Parts List. 117' at a total cost of $1602.52 = $13.69 per foot.

degrees apart. Adjustment of the race was made by 1/2" bolts threaded into clips.

A large roller bearing was given to me; it had been taken from the main axle of a diesel locomotive, designed to support 100 tons at a speed of 120 mph. The bearing was used, but in perfect condition. With my total weight of 3 tons and one third of a revolution per minute, my safety factor was very good. I knew that, if the array did not work DX-wise using this bearing, at least I could have the fastest beam in the west. This particular bearing was made by Timken (model # 560650-561251 TS); many similar bearings are used in industry.



The main roller bearing.

Eight gallons of #20 motor oil was poured in the bottom of the tube for lubrication of roller bearing. Note the 1/2" pipe running from the top of concrete to the bottom of the bearing, to remove any water mixed in the oil because of condensation.

A bronze bearing was machined to fit the top and inside of the 18" tube. This bearing is 4" wide and just under 2" thick, giving a clearance of .063". Rotation of the mast is so easy that my wife can turn it with one hand. A rain shield is welded to the mast just above the concrete tube to prevent rain running down into the oil. A step down ratio of 6 to 1 is made by having a Boston gear sprocket of 60 teeth reduced to 10 teeth on

The Brown Bomber – ready for action.

the rotator. The chain is of standard 5/8" roller type. With this gear ratio, any type of rotator will handle this job; at present I am using a Johnson rotator (which is more than ample).

A small 3" steel block using 3/8" steel cable is mounted at the very top of the mast for hoisting beams, as well as a bosun's chair (for ease when working, painting, etc.). A breakdown of costs can be seen in Table 1.

After finishing the welding and painting (2 coats) of the four sections, I borrowed a wrecking tow truck and carried the four sections to the erection site. The four sections were then put together on top of concrete blocks, so that the mast was several feet off of the ground. Wooden forms were constructed at each end of the mast and piano wire was stretched on the top and one side. With the use of the jack, shims were placed at various points to make the 127' mast as straight as possible; at this time tack welds were made on the top side. The mast was then rotated 180 degrees and the same operation repeated. After tack welding every 90 degrees and again checking for straightness, the complete welding of each joint was accomplished. The welds were wire brushed and painted.

Erection time for the mast was here. A large truck crane with a 65' boom and a capacity of 30 tons was hired for the job. By trial and error we found the balance point to be 40' from the bottom end. A steel cable sling was placed 10' higher, in order to keep the bottom of the mast heavy. As the top of the mast climbed to about 30 degrees above the ground, the mast looked as if it were a giant fishing pole with a large catch on the end. My mind was wondering whether the welds would hold. In a few seconds the mast was at about 60 degrees and the bending was decreased. In short time, the mast was vertical and the crane engineer started to swing it toward the concrete tube. Needless to say, there was quite a feeling of relief when the mast started into the tube. This turned out to be quite a show for my neighbors and DX friends.

Incidentally, considerable cost may be saved by using used pipe, so I'll see you at the junkyard.

. . . WØSYK

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Build a Deluxe TTY Keyboard

Conclusion

The last time under this heading, a TTY keyboard was described that performed about as well as your old model 15; about the only positive feature of that keyboard was that it didn't make as much noise. Well, don't give up yet. Described in the following paragraphs are the features that make the keyboard truly deluxe. These features are in some cases mutually optional and their circuitry differs slightly whether used alone or with a complete system. If that is the case, both circuits are shown. The options described here are divided into three assemblies: 1) character counter; 2) auto function module (AFM); and 3) TTY signal generator.

Character Counter

The first addition to the basic keyboard is the character counter. This is a handy device

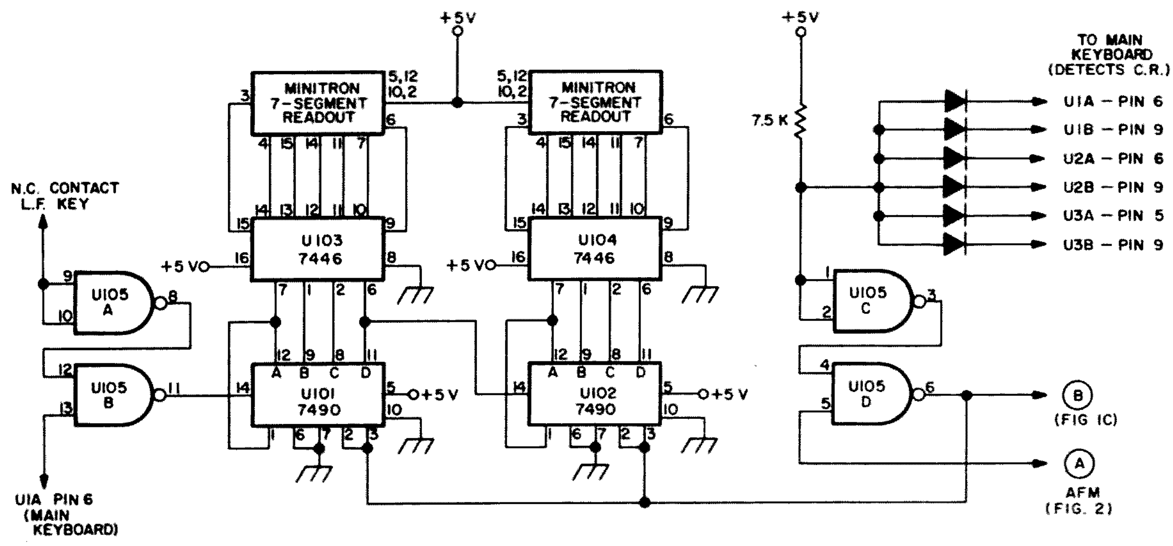

Fig. 1(a). Character counter.

if you are typing into an unseen page printer. In addition to providing an indication of the number of characters transmitted since the last line feed, a "beep" sounds to indicate that a line is nearly full. The circuit, shown in Fig. 1, is a straight BCD counter with decoders to drive a pair of 7-segment indicators. In the prototype, the indicators are the incandescent Minitron type, although LED displays could have been used.

The input to the counter is connected to the Q of U1A (in the keyboard) and toggles every time a stop pulse is entered into the keyboard shift register. The extra gating at the input inhibits the count whenever a machine function is transmitted, since those result in no carriage travel in a page printer. In order to inhibit count during the transmission of these functions, double pole key switches are required for the LF (line feed), LTRS, and FIGS keys. If the AFM is used, a double throw switch is needed only for the LF key, since the LTRS and the FIGS keys are not connected to the keyboard register in this case. The count gate circuitry shown in Fig. 1(b) is used when the AFM is not included.

The character counter should obviously be reset by the transmission of CR (carriage return). This is accomplished by using a diode gate that detects the presence of CR in the keyboard shift register. The extra reset input (terminal A) is provided for the eventual use of the automatic CR/LF circuit.

The diodes connected to the outputs of U101 and U102 decode, in this case, 62 or some other number designated as approaching a full line. The output of this decoder drives the auto CR/LF and the warning beep. Another diode decoder detects a count of ten more. By the way, any number can be decoded from the character counter simply by connecting diodes to all counter outputs that are high at that particular count. For example, a full line could be 56 characters long, so that 46 (giving ten spaces warning) would be decoded to drive the beeper. This would be done with diodes connected to B and C of the units stage (U101) and C of the ten stage. While this decoder will also give true (high) outputs at counts 47, 56, 57, 66, 67, 76 and 77, the counter reaches 46 first so all subsequent outputs can be ignored.

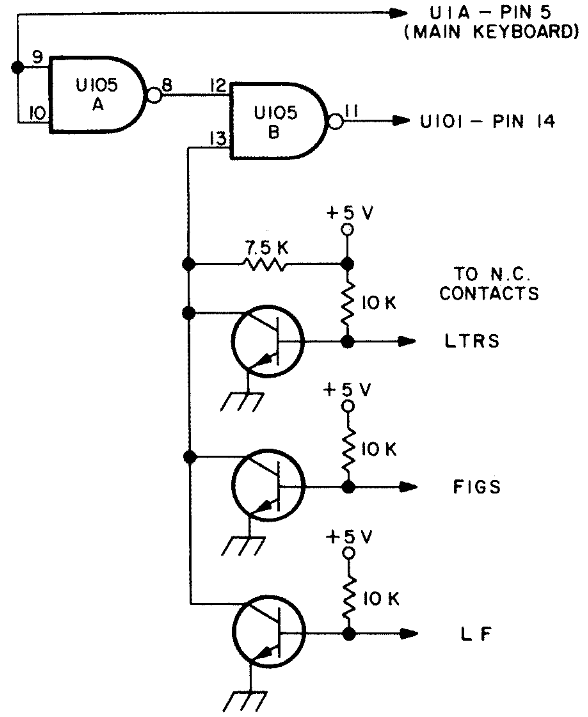

Fig. 1(b). Alternate count gate circuitry for use without AFM. Transistors are NPN silicon switches. U105 and U107 are 7400. Vcc – pin 14. GND – pin 7.

The function of the warning beep is similar to the warning bell on a typewriter or some teleprinters. The high output of the decoder drives a 74121 one-shot with a period of .5 seconds. The output of the one-shot drives a NE555 connected as an oscillator driving a small speaker. When the one-shot triggers, a latch is set to inhibit further triggering of the beeper until the next line.

Auto Function Module

This addition, while of slightly greater complexity than the original keyboard, increases operating ease more than enough to offset the increased complexity and cost. The auto function module (AFM) includes both auto/shift and auto CR/LF since both involve similar circuitry.

The heart of both operations is a shift register similar to the one used in the basic keyboard. The main difference between this TTY generator and the keyboard generator is that this one produces only three different code groups: LTRS, FIGS and CR. Note that the AFM shift register is connected in series with the keyboard register by gates U202A, B only when there is data in the

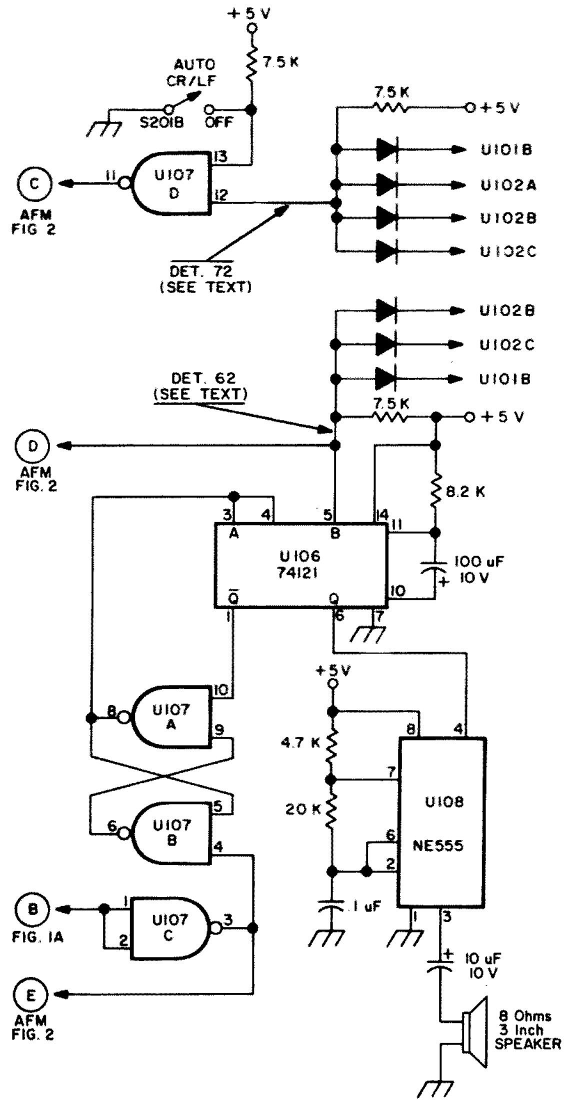

Fig. 1(c). End-of-line warning beeper and character count decode.

AFM register. At all other times, it is effectively out of the circuit.

The auto shift function uses most of the components in this module (see Fig. 2). The two extra toroids in the keyboard matrix are now used. The matrix should be wired so that wires from lower case keys pass through the LTRS core while wires from upper case keys go through the FIGS core. Not every upper case character should have a key of its own. Some of the characters are used so seldom that a separate key switch would not be worth the space it takes. In the original unit, only the numbers, period, question mark and slash have separate keys. Of course, the choice of upper case keys is up to the individual.

The auto shift circuit not only encodes and inserts shift functions, it also determines when they should be added. While it would be workable to include a shift function before every character transmitted, the effective speed of communication would be halved. Thus, circuitry is included to insert a shift function only when required. For example, when transmitting a call (K7YGP/7), the symbols are typed as written. The circuitry then inserts FIGS only before the first 7 and the / and inserts LTRS only before the K and Y. What it boils down to is that the circuit generates a shift function only at the beginning of a series of like cased characters. Operationally, this results in the generation of alternate shifts: FIGS then LTRS then FIGS – never two of the same in a row.

The auto shift circuitry derives its commands from the two shift toroids in the matrix and two shift keys (FIGS and LTRS). Assume that the U204A, U204B latch is set so the output of U204A is low and that of U204B is high (FIGS was the last shift command). The low applied to U205B pin 9 keeps its output high so no pulses from the FIGS toroid reach the output. Assuming pin 2 of U205A is also high, a pulse from the LTRS toroid will appear as a low going pulse at the output of U205A. This pulse is applied to U204A, causing that latch to change state, inhibiting the LTRS input and releasing the FIGS input. The LTRS pulse is also applied to U205C and U210A, B, C, setting the shift register to LTRS coding. If an upper case key is next pressed, the U204A, B latch will be driven to its original state and FIGS coding will be set into the register through U205C and U210A, C. The LED indicators at the output of the latch show the last shift function sent. Differentiated pulses from the manual shift keys trigger their associated one-shots (U206A, B). The outputs of the one-shot performed the same function as the pulses from the auto shift toroids except that the input gates (U205A, B) are bypassed allowing one shift function to be generated with each push of the key. The U204C, D latch is set when the manual FIGS key is pressed. When set, the latch lights the FIGS LOCK light and applies a low signal to U205A, inhibiting the auto LTRS signal. This permits transmitting upper case characters that have no separate

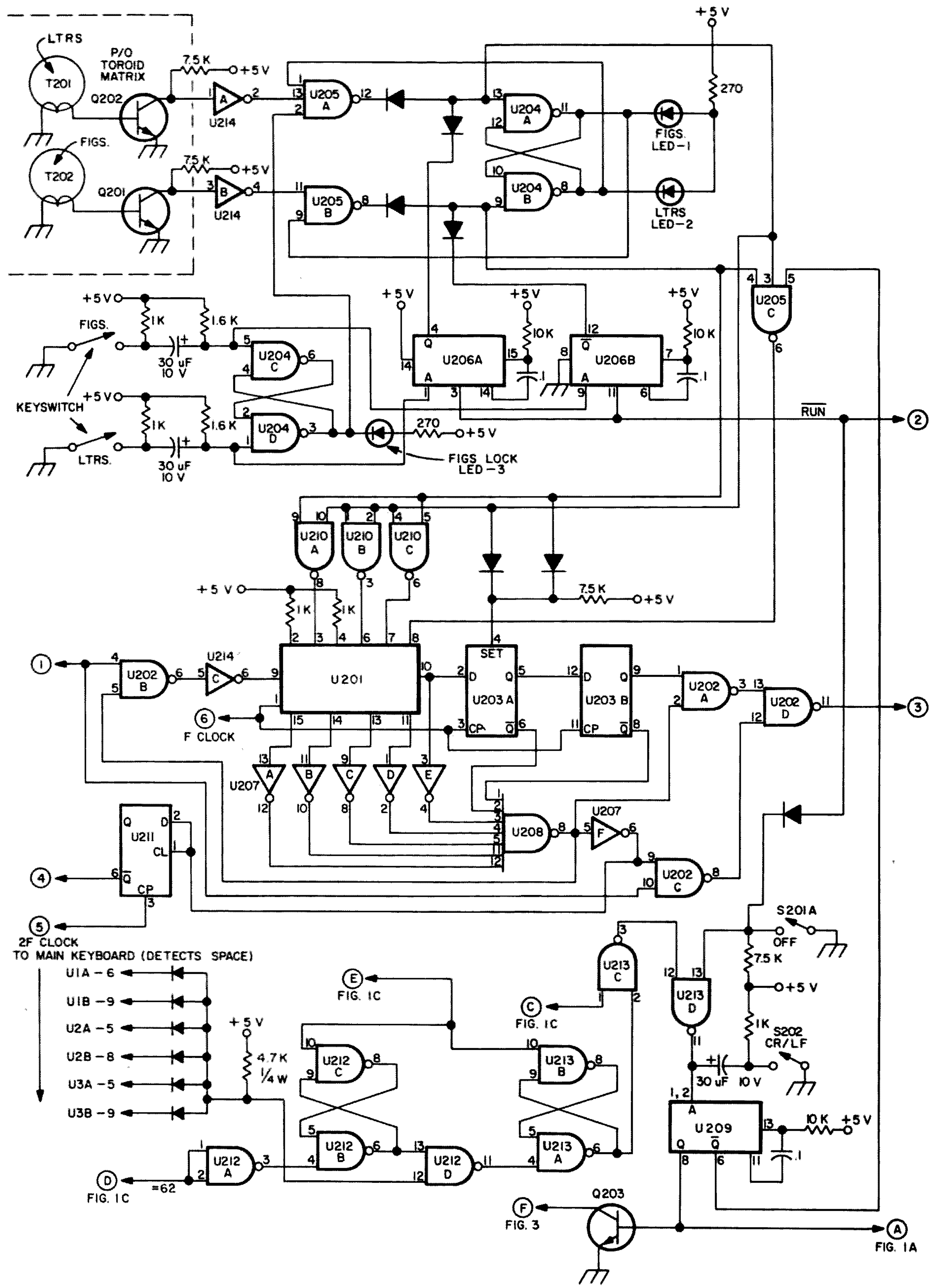

Fig. 2. Automatic function module (AFM). Vcc on pin 14 and ground on pin 7 of all ICs but U201: Vcc — pin 5, GND — pin 12. AFM terminal connections to the basic keyboard: 1 — connects to output of "output gate;" 2 — connects to line that goes low when clock is running; 3 — connects to base resistor of loop keyer; 4 — connects to temporarily grounded input of NOR gate (UGA?); 5 — connects to 2F clock; 6 — connects to 1F clock buffer (the one that goes nowhere).

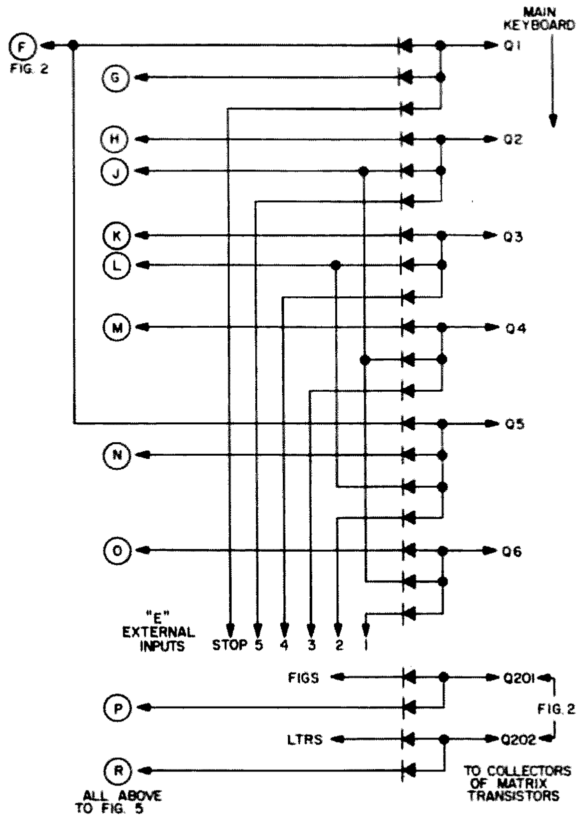

Fig. 3. Auxiliary encoding matrix — all diodes germanium.

key. The latch is reset by pressing the manual LTRS key, returning the circuitry to auto shift operation.

The shift register, composed of U201 and U203A, B, while different componentwise from the keyboard register, is logically the same. When the register is empty (full of space coding), all the low outputs of U201 are inverted by U207A through E and applied to U208 along with the high signals from U203A and U203B. The output of U208 controls clocking the same way as its counterpart in the keyboard register. The only difference is that the U208 output also controls gates U202A, B, C. These place the AFM register in the circuit, in series with the keyboard register, when it (AFM) contains data, and bypasses it when empty.

The other function of the AFM is to insert CR/LF when the end of a line approaches. The same signal that drives the end of line warning also initiates the operation of the auto CR/LF. In case you are in the middle of a word, the circuitry is set up so that CR/LF is inserted only after the first space sent after end of line warning. As a failsafe feature, CR/LF insertion is actuated by an end of line signal (warning plus 10 more characters), whether or not the last word is completed. Originally, CR/LF was initiated only at the end of a line. This got the job done but seemed always to occur in the middle of a word — which tended to be a little distracting. The present circuit gives CR/LF somewhere during the last ten positions of the line at the end of a word (as long as the word is not over ten letters long).

Since several of the functions to be described require encoding access to the main keyboard shift register, a method of auxiliary encoding is necessary (see Fig. 3). In spite of what was said about diode matrices in the last part ("Where do you find room for all those diodes?" or something like that), that is exactly what is used here. Different methods were tried to electronically actuate the toroid matrix but none worked. This was probably due to the fast rising, high current pulse required on the matrix primaries. Anyway, this group of diodes is connected to the collectors of the matrix switching transistors. Grounding the cathode end of the diode sets the associated register stage(s). You will notice three sets of diode matrix inputs. The first set goes to the AFM for setting LF. The second set connects to the signal generator (may be omitted if the signal generator is). The last set, labeled external, goes nowhere at the moment. Its eventual use will be for inputting externally generated parallel data from a tape reader or a video terminal or something else I haven't thought of, but you might. Of course, those diodes can be omitted without effecting the operation of the keyboard or its accessories. All the matrix diodes in the prototype were mounted on the same board as the toroid matrix. But that is enough about a bunch of diodes — let's get back to the AFM and its auto CR/LF function.

This function is accomplished by the circuitry in the lower part of Fig. 2. When an end of line warning signal (end of a line minus ten) is received, the U212B, C latch is set. This places a high on one input of U212D. When sometime later a space is set into the main shift register, this event is detected by D1 through 6 and a brief high pulse appears on the other input of U212D. This sets the U213A, B latch output low.

The low is inverted and applied to one input U213D. Since the keyboard is transmitting a space, the $\overline{\text{RUN}}$ is low, preventing the output of U213D from going high. As soon as the $\overline{\text{RUN}}$ line goes high, the U213D goes high and triggers the U209 one-shot. The pulse does several things: 1) The AFM shift register is loaded with coding for carriage return; 2) a set of diodes at the auxiliary coding matrix is grounded by Q203, loading the main keyboard register with coding for line feed; and 3) the character counter is reset. Resetting of the character counter also rests the two latches in the auto CR/LF circuitry. After a carriage return and a line feed are shifted out of the keyboard, the $\overline{\text{RUN}}$ line goes high and the keyboard is free to start transmitting a new line.

The failsafe CR/LF is initiated by an end of line count which places a low at the input of U213C. Just like the low from U213A, this produces a high output from U213C. From here failsafe operation is the same as for a normally initiated CR/LF.

Signal Generators

While the inclusion of TTY signal generators in the keyboard does not improve ease of operation, there are instances where a source of low distortion signals proves useful. The signal generator included here generates either RY signals or a modified binary sequence of all characters (binary QBF). A source of continuous RYs is handy in making range adjustments to printers. Since one character has all odd pulses mark and the other has all even pulses mark, the sequence produces the maximum amount of movement within a mechanical printer. So if anything is going to go wrong it will do so with RYs. The latter signal is a cheap and dirty method of producing all possible TTY characters as a Quick Brown Fox generator does. While the sequence appears random, it will become familiar after a few repetitions (see Fig. 4). If a true Quick Brown Fox is desired, a custom ROM (read only memory, such as the 8223) could be designed into the circuit. This is not done since the benefits are not worth the added expense.

Now a little about how it works. Since we already have a set of shift registers capable of producing properly timed pulses, we only need a means of automatically programming the registers. That's what the circuit of Fig. 5 does. Most of the circuitry is common to both the RY and binary QBF generators, but since the RY generator is simpler we will start the explanation with the signal generator in that mode.

With S301 in the off position the binary counter (U305, U304) is reset and the output of U301B is held low, keeping the circuit inactive. S302 in the RY position keeps the QBF output gates (U302, U303) inactive no matter what (a high output is inactive). Assuming there is no other activity in the keyboard ($\overline{\text{RUN}}$ high, = $\overline{72}$ high), opening S301 removes the reset signal from the counter and permits the output of U301B to go high. Through U303D a stop pulse and through U301D the coding for R is set into the main keyboard shift register. With data in the register, the $\overline{\text{RUN}}$ line goes low and the output of U301B goes low, causing all data gates to become inactive and toggling U304B. When the keyboard register clears, the output of U301B goes high once

Output from binary QBF:

Blank, Space, Carriage Return, N, Line Feed, I, R, C, E, S, D, F, A, U, J, K, T, H, O, M, L, P, G, V, Z, Y, B, X, W, Q, FIGS, LTRS (and repeat in upper case);

Its appearance on a page printer is:

N
,IRCESDFAUJKTHOMLPGVZYBXWQ
N84:3$!–7'(5#9.)Ø&;"6?/21
IRCESDFAUJKTHOMLPGVZYBXWQ . . . etc.

Fig. 4. Binary QBF output.

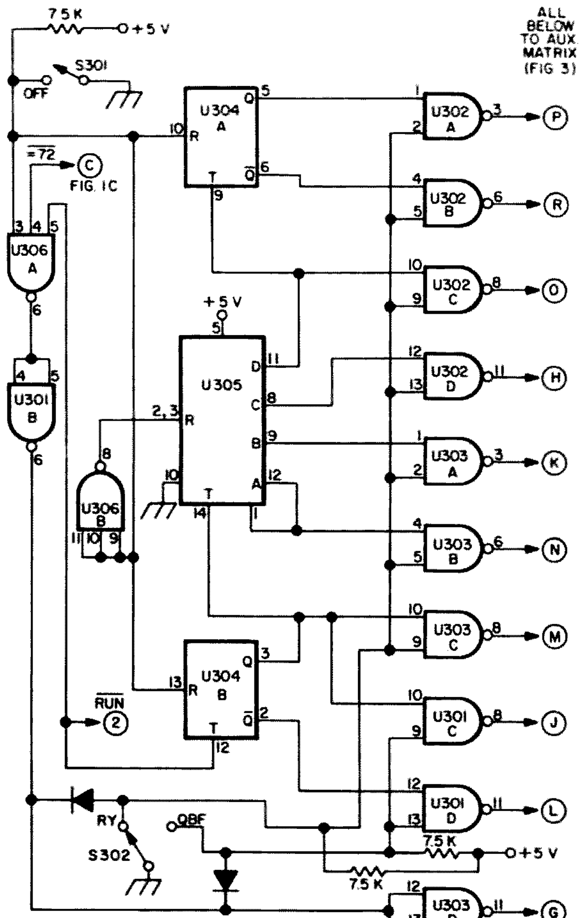

Fig. 5. Signal generator. Vcc on pin 14 and GND on pin 7 of all ICs except U305: Vcc – pin 5, GND – pin 10. All resistors ¼ W, all diodes germanium.

again. This time the keyboard register is set through U303D and U301C (Y coding). This process repeats itself forever until shut off or an auto CR/LF is initiated. The latter interrupts the generator only long enough to insert coding for CR/LF. This is kind of handy if your printer doesn't have some means of overprint prevention built into it. If you're not watching and the printer is stuck at the end of a line, it won't take long until the machine has beat a hole through the paper (sure makes that last letter illegible).

The operation of the binary QBF is much the same except the entire counter and the U303 and U302 output gate are used. After each character is entered into the shift register, the counter changes state in preparation for the next character. The gates controlled by U304A insert shift information into the auto shift circuitry so that alternate lines of printout are in alternate case. When the signal generator is in this mode, auto CR/LF is inactive since the character counter never reaches a full line count. So it makes no difference whether the auto CR/LF is on or off.

Now that we have a signal generator capable of transmitting both RY and a binary QBF you may wonder what to do with it. Using RY for setting the range on a mechanical printer has already been mentioned. Using the signal to measure the bias of a system (demodulator, loop keyer, etc.) has been covered in another article.[1] It should be noted that the mark duty cycle of this generator is 53.3% rather than the usual 50% duty cycle used to measure distortion. Compensation has to be made for this when taking loop bias measurements by setting 53.3% of full scale as 0 bias and slightly compressing the mark bias calibration, while slightly expanding the space bias calibration.

The primary use of the binary QBF is in checking that old printer you picked up out of Western Union's discard pile. If you run out of things to say during a QSO, you can always turn the generator on. It may take the guy on the other end a while to figure out why his machine keeps printing the same garble over and over again.

Can There Be More?

After building these goodies into your keyboard and using them for awhile, you realize that digital electronics and TTY complement each other better than a set of BNC connectors. Other operating aids and gimmicks come to mind quite readily. Admittedly, some are impractical and others are not within the financial range of most amateurs. But things like automatic identifiers (both TTY and Morse), magnetic tape data storage, readout and control of your tape reader from the keyboard, automatic speed conversion, and even a video display with selective readout (sort of an electronic ASR) are possible with a little effort and imagination.

Anyway, the field of digital communications has always been one of the most interesting to me. The idea of pushing a button here and making something happen

[1]Shinsel, "RTTY Signal Generator," *Ham Radio*, March, 1971, p. 23.

there is fascinating. The appeal is even greater when the result of that button pushing is unique and due to your own design. Some of the above mentioned gadgets are in the breadboard stage and may see publication if my soldering iron, pen and XYL hold up under the strain.

Finally, if there are any points I failed to cover well enough or missed completely, or if anyone has ideas to discuss, please write and I will respond as well as I can (SASE, please — I too am poor and unable to afford sugar).

IC Parts List

Counter: Fig. 1.
U101, U102 – 7490
U103, U104 – 7446 or 7447
U105, U107 – 7400
U106 – 74121
U108 – NE555

AFM: Fig. 2.
U201 – 7496
U202, U204, U210, U212, U213 – 7400
U203, U211 – 7474
U205 – 7410
U206 – 74123
U207, U214 – 7404
U208 – 7430

Sig. Gen: Fig. 5.
U301, U302, U303 – 7400
U304 – 74107 (May use 7473 with different pinout)
U305 – 7493
U306 – 7410

Other Parts List

Counter: Fig. 2.
All diodes: Low leakage germanium (13 of them)
All transistors: NPN switching 2N2222 OR = (3)
All resistors: 10% ¼ W.
Capacitors: As shown, low voltage

AFM: Fig. 2.
All diodes: Low leakage germanium (13 of them)
Q201, Q202, Q203: NPN switches
Resistors and capacitors: as above S201 – DPST, S202 – min. toggle SPST

Sig. Gen: Fig. 5.
All diodes (1 of 'em), resistors as above.
S301 – SPST toggle
S302 – SPDT toggle

AEM Fig. 3.
All diodes: As above (23 this time)
All assemblies: A few .1 uF disc capacitors for Vcc buss bypasses.

AUTHOR'S NOTE: *There may be some confusion as to how the automatic function module (Fig. 2, Part II) connects to the basic keyboard (Fig. 5, Part I). Following is a list of necessary interconnections:*

BASIC KEYBOARD (Fig. 5, Part I)		AFM (Fig. 2, Part II)
A – U7A, pin 3	→	1 – U202B, pin 4
B – 1.5k resistor	→	3 – U202D, pin 11
C – U6A, pin 3	→	4 – U211, pin 6
D – U9C, pin 8	→	6 – U201, pin 1
U9D, pin 12	→	2 – U206B, pin 11
U9A, pin 3	→	5 – U211, pin 3

I certainly hope this information may alleviate any possible problems with interconnection.

. . . K7YGP/7

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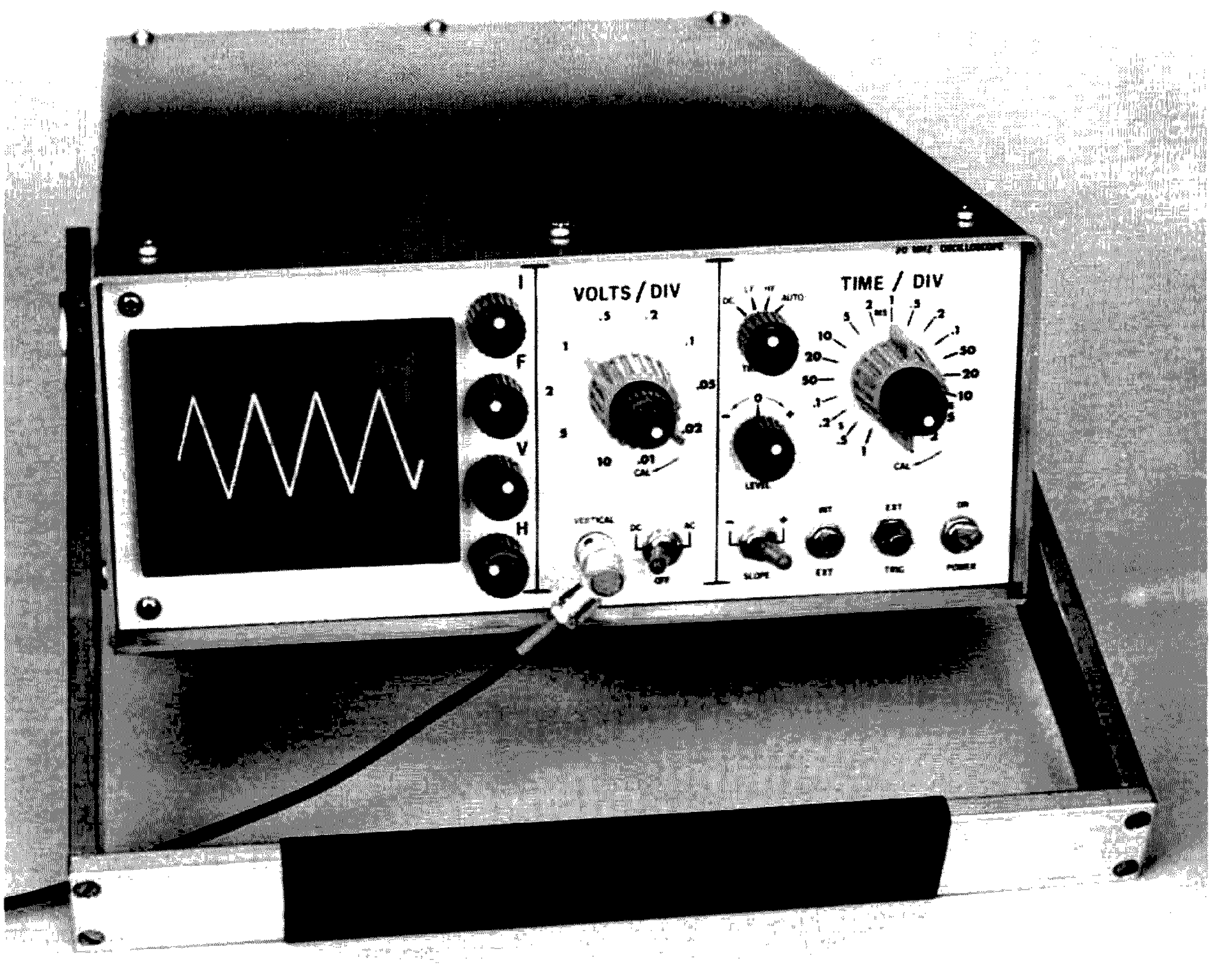
628 Marshall Ave.
Webster Groves MO 63119

Eyes For Your Shack

A project with scope.

Part One

As the complexity of our equipment has markedly increased during the last couple of years, especially along digital lines, there springs upon the ham a more and more



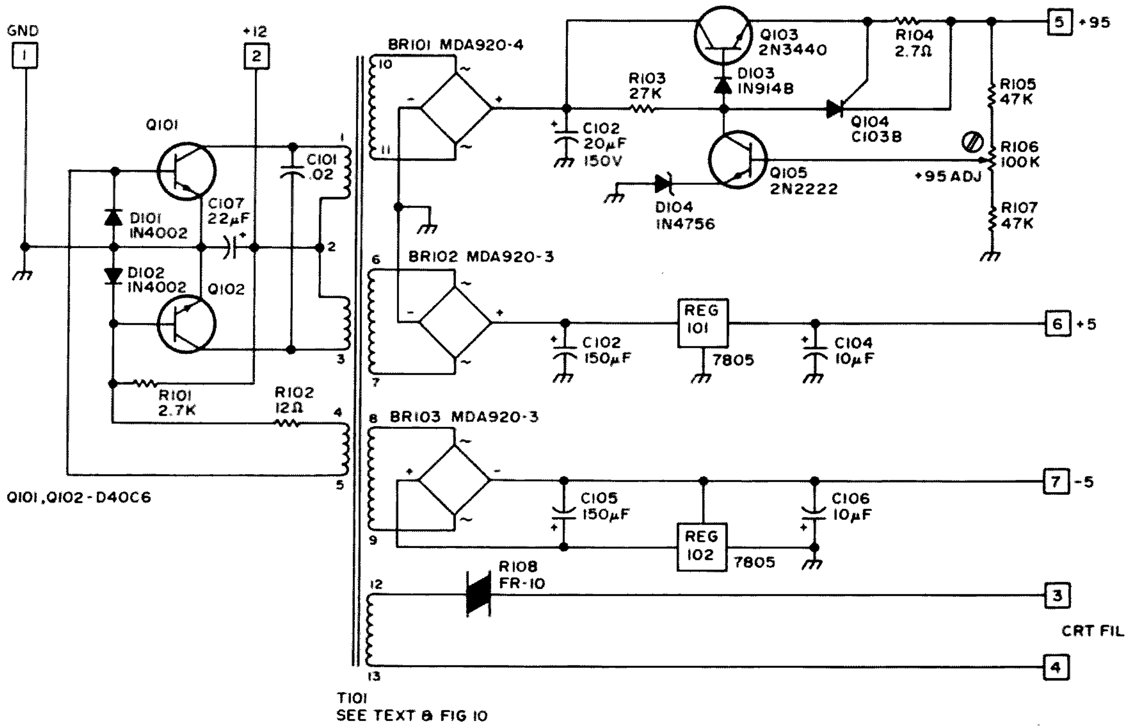


Fig. 1. LVPS schematic.

pressing need for a decent oscilloscope. Since a goodly portion of us work with limited funds, most of us are forced to put off purchasing a really good one.

Let's define a "decent ham oscilloscope": Must be inexpensive for sure . . . less than \$100; medium to wide bandwidth, say dc to 10 MHz minimum; calibrated, triggered timebase, 1 sec/div to 1 µs/div; relatively light, small (8½ x 3½ x 13) and portable; maybe even battery and ac; good to look at and easy to operate.

Armed with this outline, we can now design and build our own – and do an admirable job for less than \$100. Don't believe it? Read on!

Since this article's primary purpose is to help you make a scope, I'm going to squeeze most of the circuit's operational description into a few paragraphs now, so you won't have to wade through it later on searching for construction details.

Most of the electronics is rather mundane, so let's concentrate on the more interesting circuitry.

Low Voltage Power Supply

One thing interesting about the power supply is the slightly strange inverter, using D101 and D102 (Fig. 1) as commutating switches for the untapped feedback winding. This arrangement allows R102 to determine drive, while R101 produces a definitely unbalanced starting bias. Net effect is an exceptionally efficient inverter, quite a bit better than the usual tapped winding kind, in this type of service.

The 95 V regulator's pass transistor Q103 is protected against accidental shorts (Murphy screwdriver) by Q104, R104 and D103, which form an overcurrent shutdown. When more than 220 mA is drawn through R104, Q104 fires, depriving Q103 of base bias. D103 ensures that Q103 shuts down fully. After the short is removed, Q104 resets, and the regulator returns to normal.

The CRT filament is nearly a dead short when cold, and since inverters get rather balky under such loads, a thermistor (R108) is placed in series with the filament. R108 starts out at 10 Ohms cold, progressing to about 1 Ohm in about 20 seconds, through self-heating. By that time, the CRT filament is warm and higher in resistance. The inverter, in effect, sees a nearly constant load during the transition.

High Voltage Power Supply

The high voltage power supply (Fig. 4) is a controlled-inverter type, feeding positive

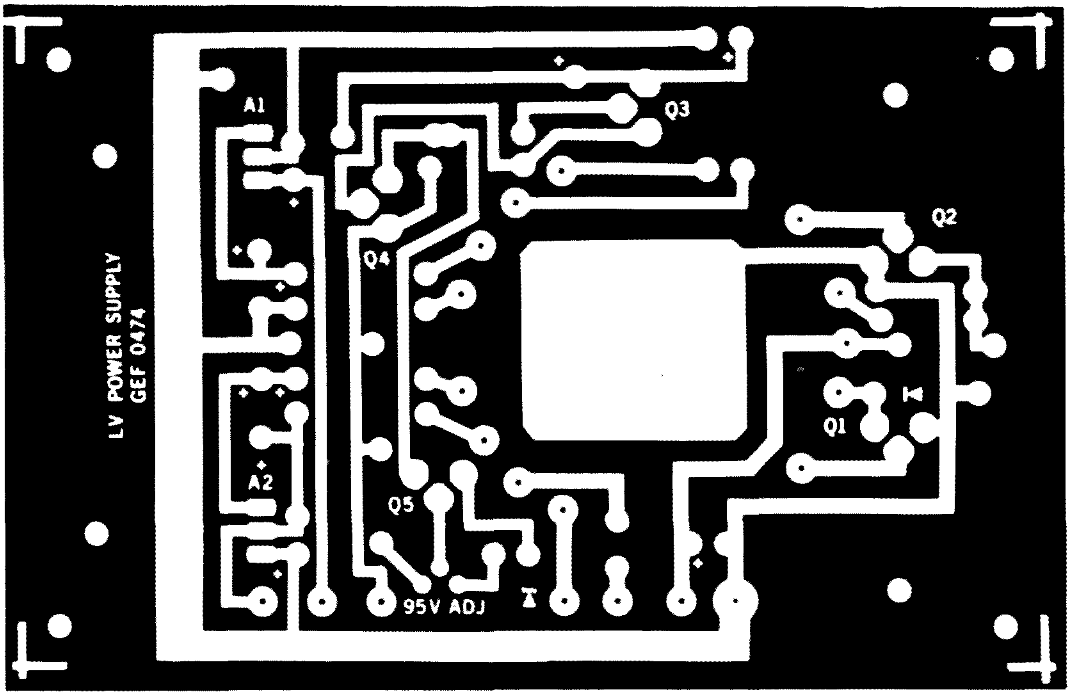


Fig. 2. LVPS PC board (full size).

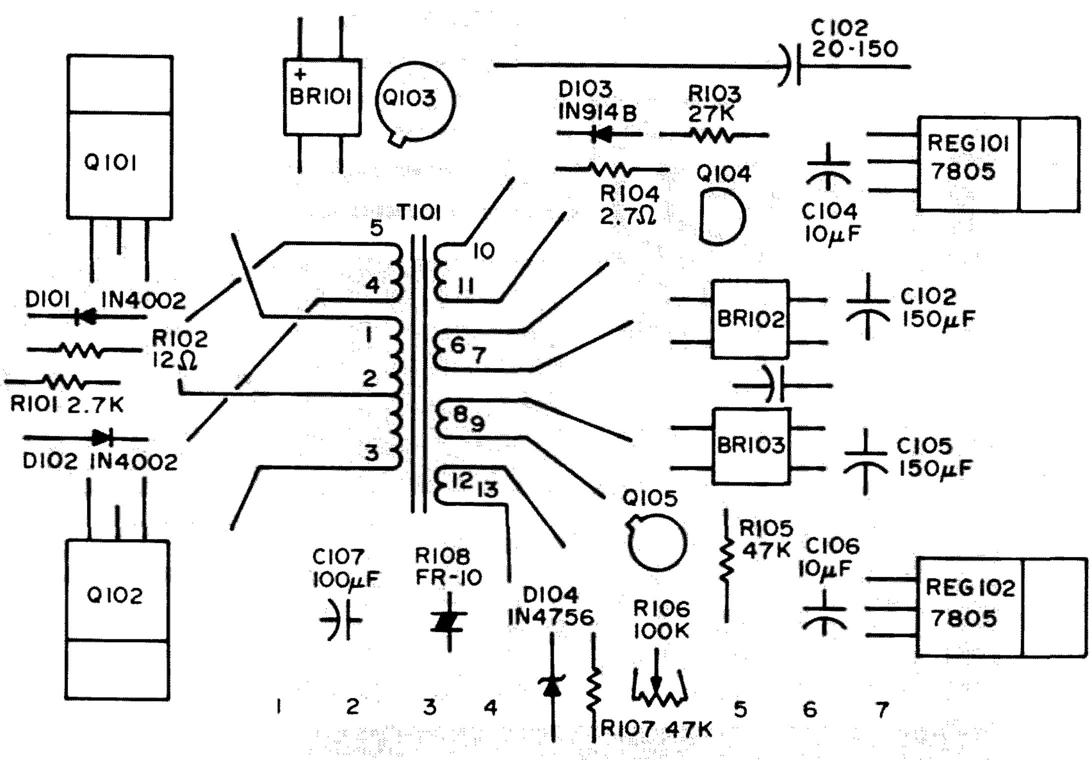


Fig. 3. LVPS component layout.

and negative triplers. A sample of inverter output, taken at the first stage of the negative tripler, is fed to Q203 and Q204. Q204 in turn controls input to the inverter, thus regulating the negative high voltage. By heavily coupling the positive multiplier, demands on the positive supply are reflected through the transformer to the negative side, causing regulation of the positive output.

Vertical Amplifier

The vertical preamp (Fig. 7) is a fully

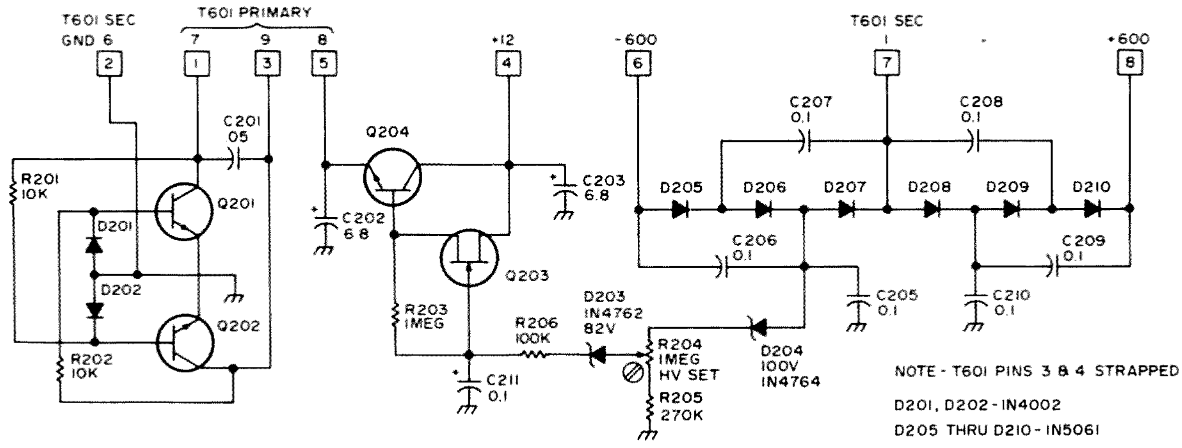


Fig. 4. HVPS schematic.

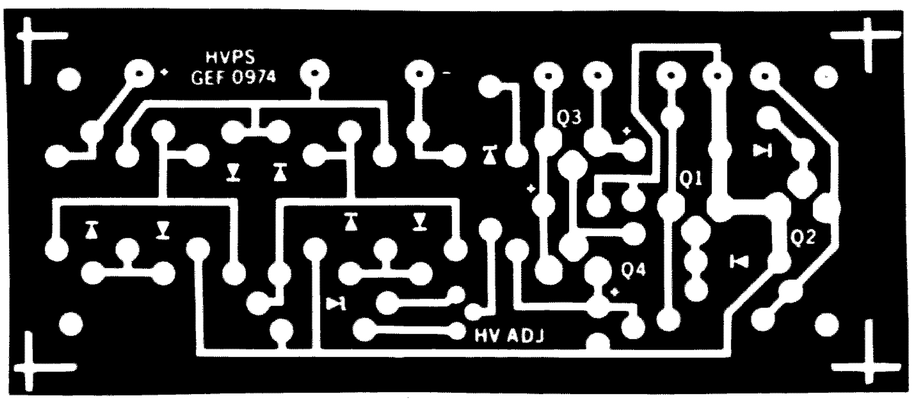


Fig. 5. HVPS PC board (full size).

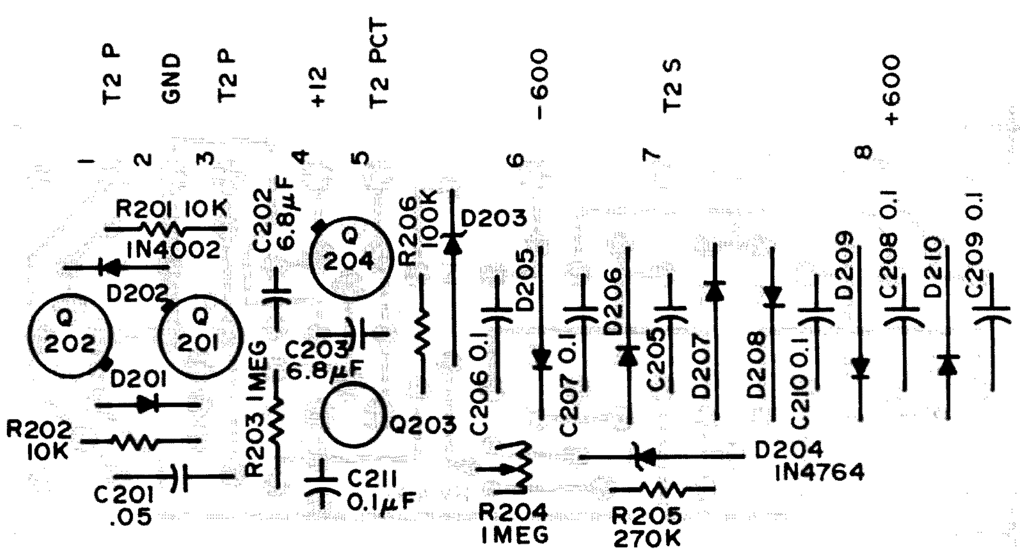


Fig. 6. HVPS component layout.

differential, monolithic FET input type. Q301 is set up as a tracking dual source follower, one side for signal impedance conversion, the other for thermal balance. Output of Q301 feeds A301 for amplification, controlled by the variable gain control and Cal pot. Dc balance of the preamp is set with R305.

Q302 through Q309 form a dual operational amplifier, working differentially with a total gain of 30. Due to feedback, Q302 (Q306)'s base is at virtual ground, allowing

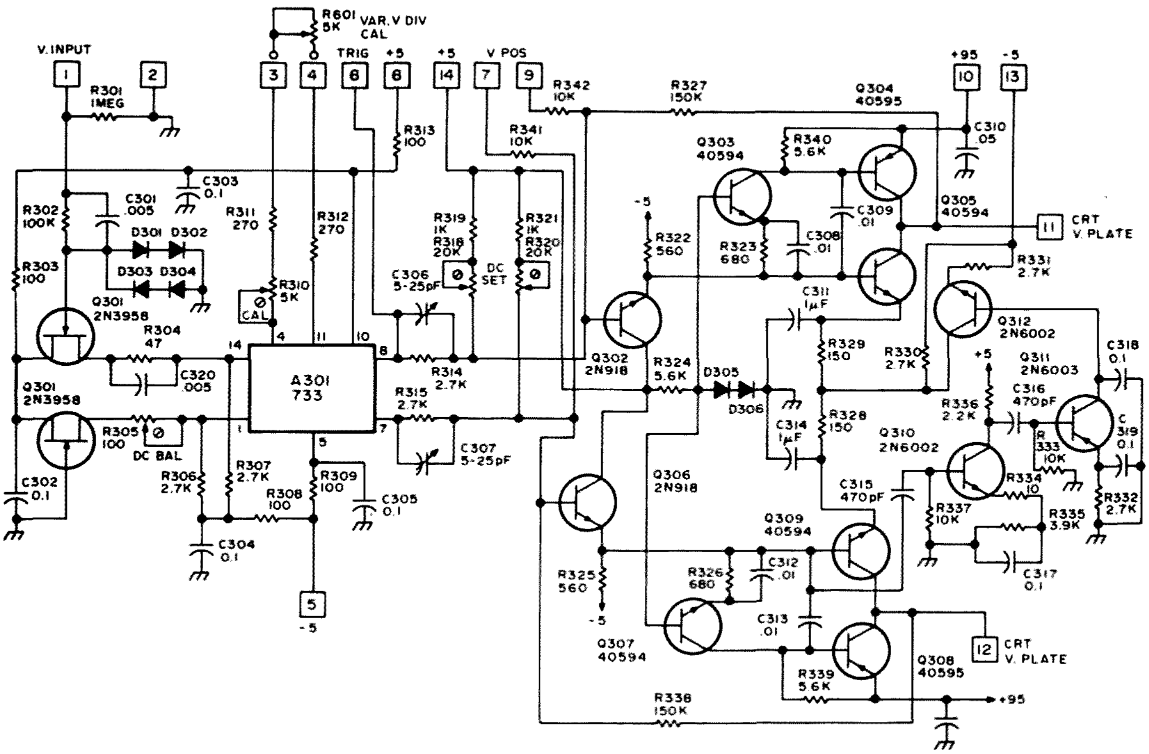
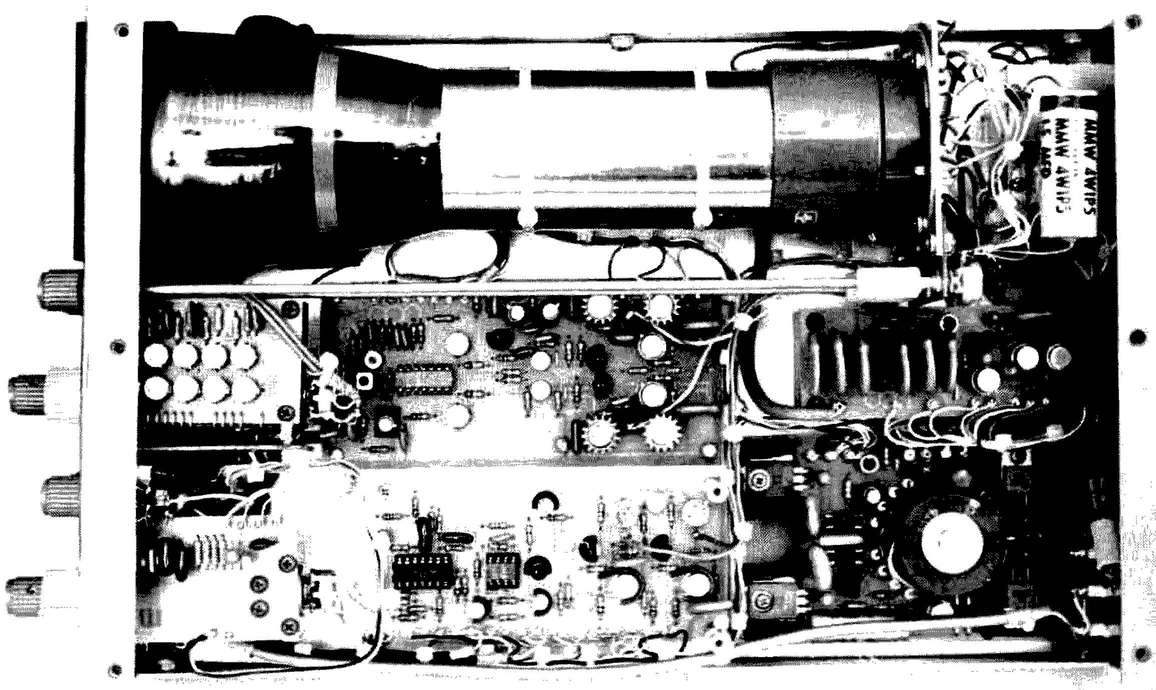


Fig. 7. Vertical amplifier schematic.



Top view of scope's interior. Center of chassis, left to right: vertical attenuator, vertical amplifier, HVPS, and, just visible under the HVPS, the blanking board. Lower portion of the chassis: timebase switch, horizontal board, and LVPS. Note intensity and focus controls mounted on CRT socket bracket; T601 and the astigmatism control are to the rear of the CRT. Battery pack not installed in this picture.

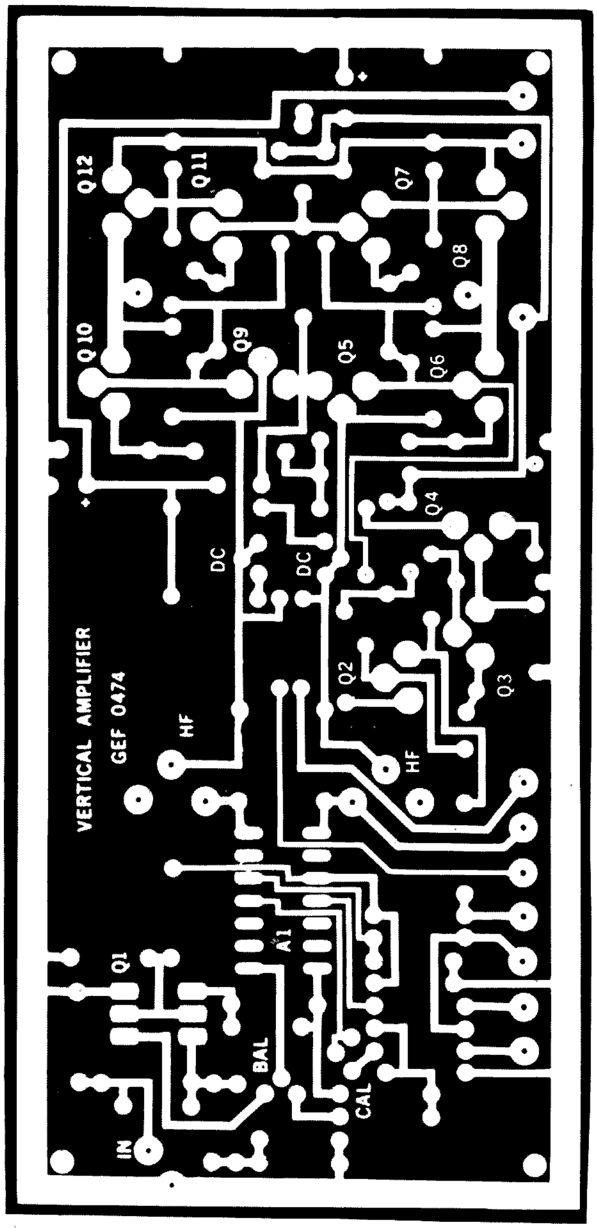


Fig. 8. Vertical amplifier PC board (full size).

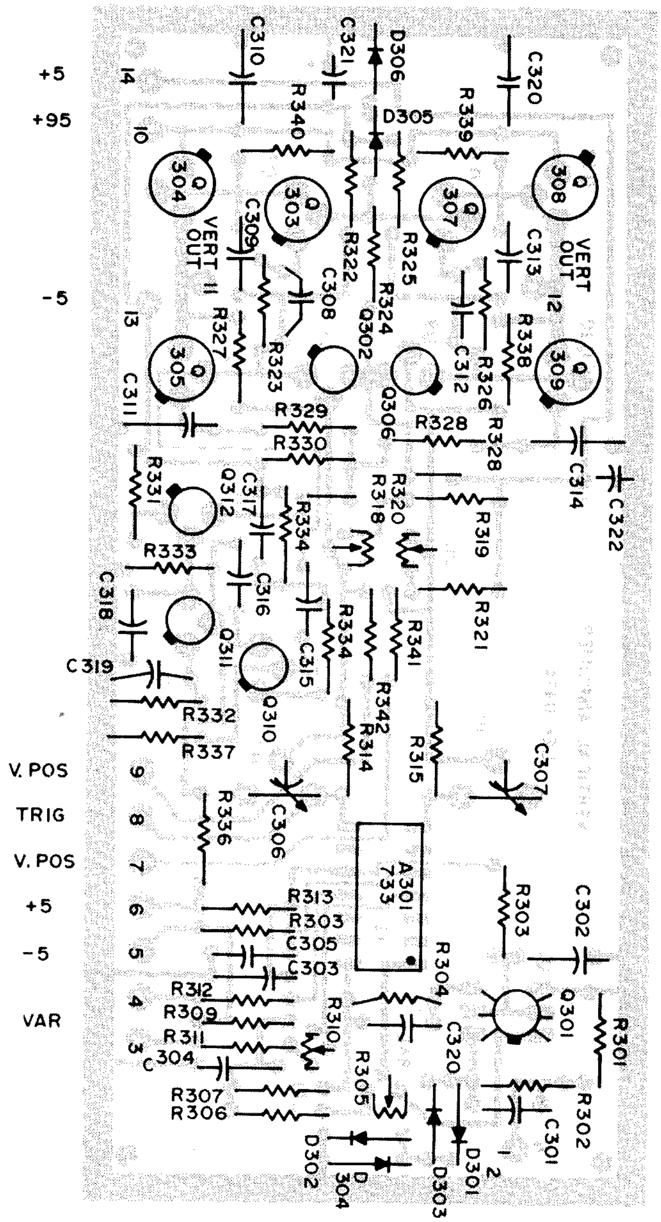


Fig. 9. Vertical amplifier component layout.

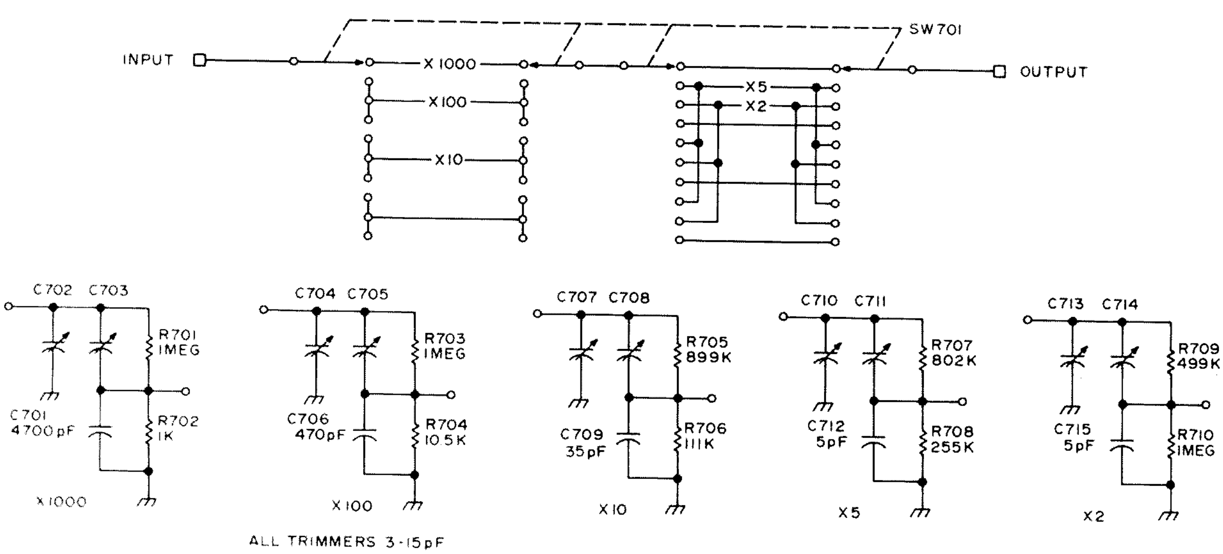


Fig. 10. Vertical attenuator schematic.

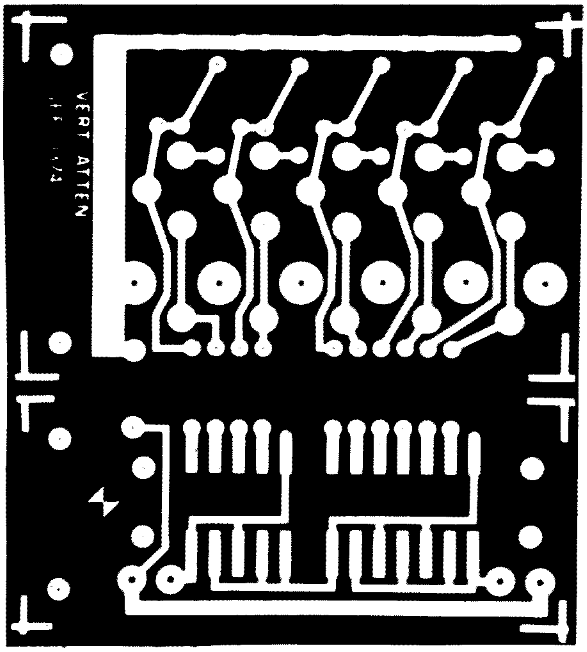


Fig. 11. Vertical attenuator PC board (full size).

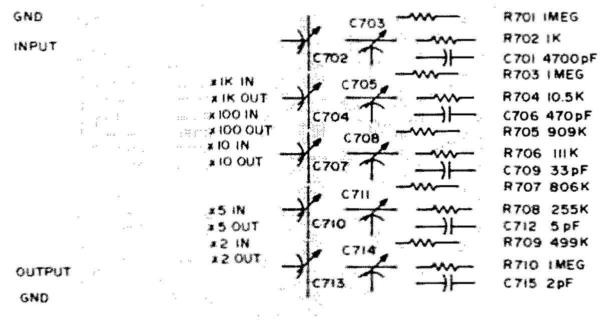


Fig. 12. Vertical attenuator component layout.

easy summing of operating point, position, and signal currents. Q303 (Q307) is an active dc coupler; Q304 (Q308) and Q305 (Q309) supply deflection voltages to the vertical plates.

Low frequency signals require much less current than high, due to the capacitive nature of the CRT load. At low frequencies (to conserve power) the output stacks are run at minimum current levels, primarily controlled by common emitter resistor R330; as the signal frequency increases, the output stacks begin to lose their ability to supply sufficient charge current, negative feedback is reduced, and signal swing at Q305 and Q309's bases increase, as it is no longer at virtual ground. Augmenting this, increased HF coupling through C315 and C316 causes Q312 to conduct, decreasing the output stack's source impedance, and thus enabling higher output currents to be developed. Although appearing to be open-ended, this HF boost circuit is operational in nature, since, in correcting the stack's

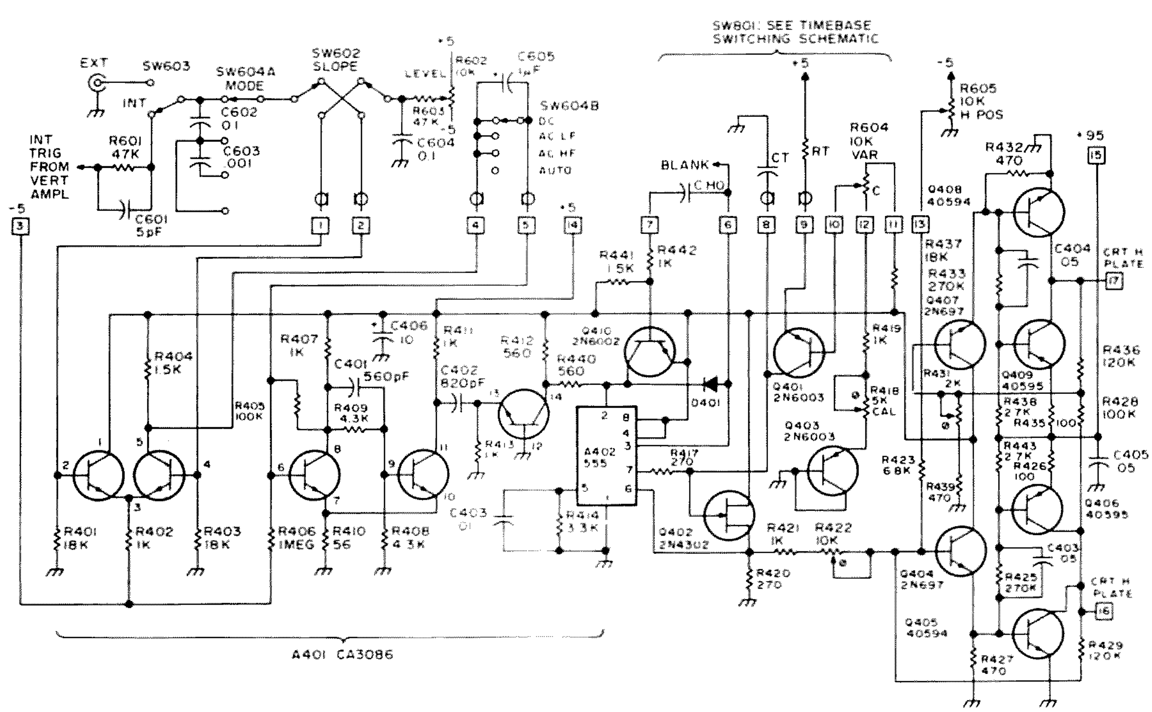


Fig. 13. Timebase schematic.

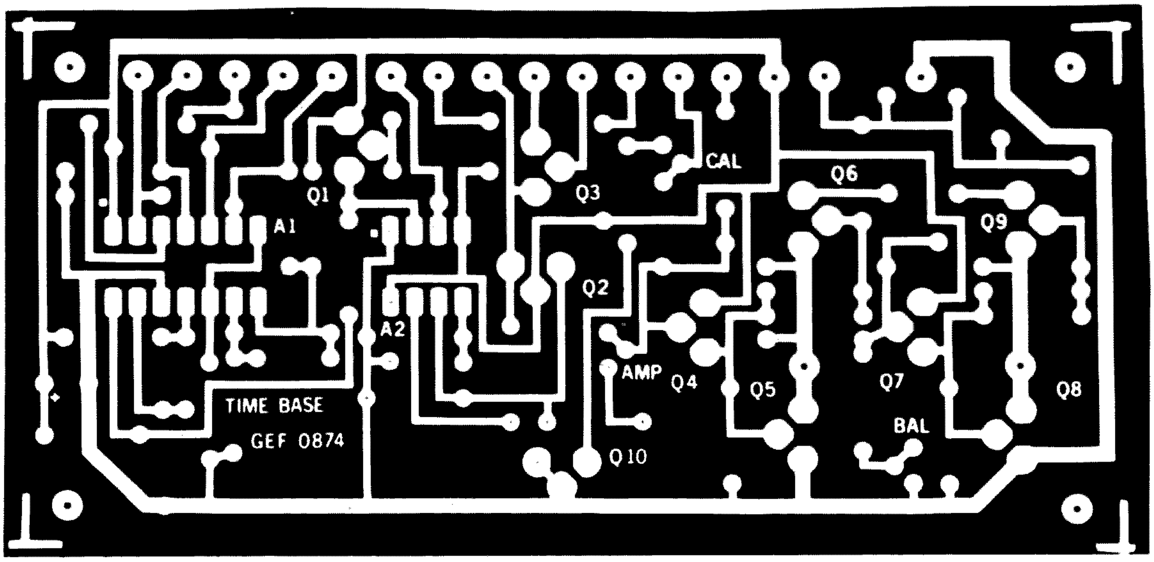


Fig. 14. Timebase PC board (full size).

deficiency, it tends to balance out its own input signal simultaneously.

Timebase Generator

Timebase trigger processing is accomplished within A401, a five transistor array (Fig. 13). The first two transistors are set up as a differential amplifier, for signal inversion. The second two transistors form a bistable Schmitt Trigger with 2.2 V threshold, which squares up the incoming waveform. Automode causes this Schmidt to freerun at about 50 Hz, syncable to the signal. The last transistor in A401 works as a pulse shaper, feeding a 50 ns negative trigger to A402, which, with current source Q401, produces sweep, blanking and holdoff. A403 temperature compensates Q401, and Q402 buffers the ramp.

Horizontal Amplifier

The buffered ramp is amplified by two similar op amps connected in series to give differential drive to the CRT plates. The first op amp performs at a gain of about 80; the second is a high level voltage follower. Balance of the output amps is set with R431. Note the use of gimmicks for HF stability.

Blanking

The blanking board (Fig. 19) must process a fast risetime signal, so the same type amplifier as in both vertical and horizontal outputs is used with a few slight changes. R505 is the collector load for Q503 for low frequency components; C502 causes Q504 to conduct on fast positive-going edges, supplying extra current to preserve

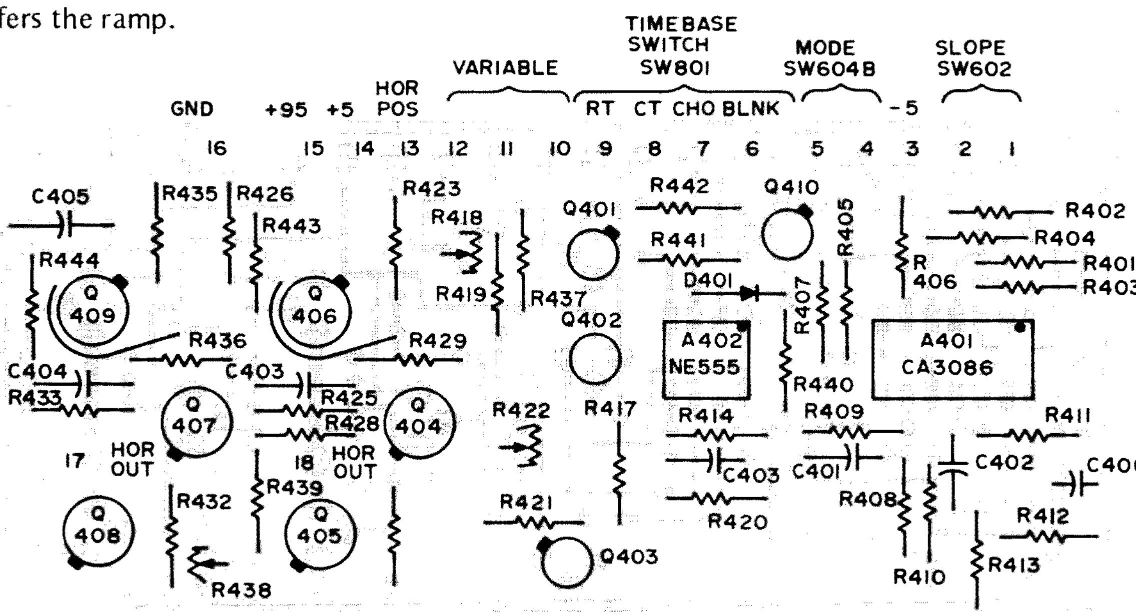


Fig. 15. Timebase component layout.

OPTIONS TO ADAPT SCOPE TO A PARTICULAR CRT

Option 1. Mono-accelerator CRT.

HVPS: Place a jumper in place of D210; don't put in C209. Cut land from D204 (anode) to D207 (anode); connect D204 (anode) to D208 (cathode). Connect normally-grounded end of C205 to junction of C210 and D209. T601 (sec) now goes to terminal 8, rather than 7. Disregard terminal 7; terminal 6 is negative 1250 V output.

BLANKING: Replace D501 with a 1N5061 rectifier *in the same direction;* it serves as an 850 V zener (no kidding). The 1N5061 is stable, but for proper blanking you may need to prune the zener stack due to variances in the 1N5061. Proper zener stack drop is indicated by 5 to 10 V across R506 with the HVPS adjusted to midrange, and no sweep.

Option 2. Higher acceleration voltage for PDA type tubes (2.5 kV).

HVPS: Use two T601 transformers; connect primaries in parallel, secondaries in series-aiding. Insulate from ground and each other. Connect to the HVPS PC board as if it were one transformer. D204 is a 1N5281 (200 V zener), and D203 is a 1N4764 (100 V).

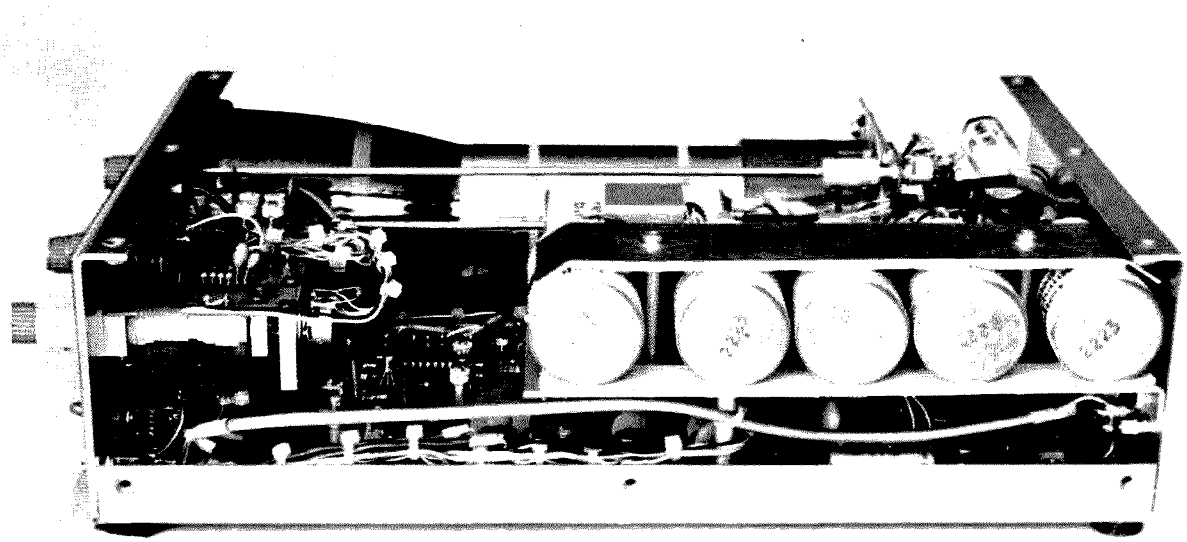
BLANKING: Same as in option 1.

risetime. D501, D502 and D503 dc couple the blanking amplifier to the CRT grid, while C503 couples the high frequency components of the blanking signal to the CRT. D504 and D506, with R509 and R510, clamp the unblanking level at 50 V below negative HV; D505 is the recharge path for C503, and D507 prevents the CRT grid from going more positive than its cathode.

CONSTRUCTION DETAILS

Picking Your CRT

Nearly all major parameters of your scope are in some way a function of the CRT you choose. On the following page is a list of some relatively common tubes; my ratings are based on adaptability to the scope, and price. The list is by no means complete. Even if your junk box has a nice bottle that's not listed, though, be sure to look for high deflection sensitivity and/or post deflection accelerator (PDA). We can trade accelerator potential for higher sensitivity (while retaining adequate brilliance) only with the PDA type tube. My 3ACP1 required this tradeoff. Mono-accelerator tubes will have a softer, less bright trace in general. Flat face types generally give superior performance, as well as look better.



The scope with battery pack installed.

CRT RATING CHART

Tube Type	Rating	Remarks
1EP–	Poor	Batteries necessary to support the filament dwarf the CRT. About $30 new.
3AP–, 3BP–, 3GP–, 3EP–	Fair	Curved face, mono-accelerator types. Most exhibit trace shift with intensity change . . . very annoying. Use option 1. Price, $4 up in general.
3ACP–, 3ADP–	Good	Flat face, PDA type, capable of good trace brilliance; use of reduced accelerator potentials gives 20 V/in deflection sensitivity. Can be had for $4 surplus to $40 new, in P1, P7, P11; P1 (green) is best, P7 (short blue, long yellow) is OK, P11 (blue) is passable.
3AYP–, 3XP–	Good	Interchangeable tubes; 3AYP– is almost flat face version. Mono-accelerator types with good deflection sensitivity. Option 1 for this one. Price (3XP–) $5 surplus to $60 for a new 3AYP–. Suggestion: Buy a cheap 3XP– first, then upgrade to a 3AYP– later.
3BQP–	Fair	Excellent performer, mono-accelerator type. Option 1. High price holds my rating down ($60 new).
5ABP–, 5ADP–	Good	Flat face, good sensitivity, PDA types. Length (17") makes scope rather long. Use option 2.
5BP–, 5CP–	Poor	Curved face, old design. Has trace shift with intensity change. Option 1.
5BTP–	Good	Very short tube (12"), making it ideal for a "mini" 5" scope. You'll need option 2 for this tube.
5UP–	Fair	Almost flat face, mono-accelerator tube. Not too bright. Use option 1.
D7-190	Good	Flat face, mono-accelerator, P31 tube. Drawing 300 mA, it will give better battery life. $55 new from Amperex.
D7-191	Good	Like D7-190, except even lower filament current, 95 mA. Batteries will really last with this one! $55 new. Option 1.
D13-480	Good	Five inch version of D7-190. Very short tube (12.5"); use option 1.
D13-481	Good	Five incher with 95 mA filament; otherwise identical to D13-480.

When making your CRT choice, temper your decision with just how large you intend your scope to be (try fitting a 5ABP1 into an 8½ x 3½ x 13 case!), availability, which varies widely, and cost, since this is probably the most expensive single item of the entire project.

By the way, don't pass up a P7 type (short blue, long yellow). They are usually cheap, and give you Instant Memoscope, simply by changing a blue plexiglas graticule to yellow!

Picking Your Power

You also will need a 12 volt power source, namely 2 to 5 A-H rechargeable batteries.

Regarding your choice of battery type, let me interject a very biased opinion: The sealed lead-acid cells presently produced by Gates Energy Products Inc. are far superior to equivalent capacity nicads in this usage. (No, I don't work for Gates.) Several reasons

prompt this rather strong statement: The Gates batteries do not exhibit the definite limits sealed nicads are well known for, such as memory, cell reversal, and thermal runaway problems. Also, the Gates cells may be fully charged in 3 to 4 hours without harm, adding to the convenience of your scope. And according to Gates, moderate overcharge will not destroy the cells.

On the other hand, nicads are, within their limitations, excellent batteries, so if you have a bunch, you can certainly use them with the nicad network to be explained later.

Another good choice for your oscilloscope is the Gel-Cell, basically a lead-acid type, and in essence, sealed (if you don't charge 'em too fast). Use the nicad network for these batteries, also.

By the way, if you feel you must put the charger within the scope, mount the power transformer *with tape* directly behind the CRT, and be prepared to turn it for minimum beam disturbance. Then and only then, bolt it down.

Basic Case Layout

Sounds a little out of order, but now's the time to make a rough sketch of your case. Just use the PC board sizes (parts list) as a guide; if you intend to build on vectorboard, increase these dimensions 50%. A few pointers: This is only intended to be a "first fitting," so just sketch it! Also, avoid cramming it in – leave yourself some room, and construction will be almost as enjoyable as showing the finished scope to your friends.

Try to follow the general layout philosophy of my scope as much as possible (see photos). Things to consider: Keep the vertical and horizontal boards as close to their respective front panel controls as possible (cuts down on shielding requirements). Power supplies should be as far from the front ends of the vertical and horizontal boards as possible. Leave a little space around the boards to enable possible shield installation later (Edsel Murphy); plan enough space for a CRT shield; front panel controls should be arranged with an eye to functionality, symmetry, and cabling ease. Enough work on the case for now.

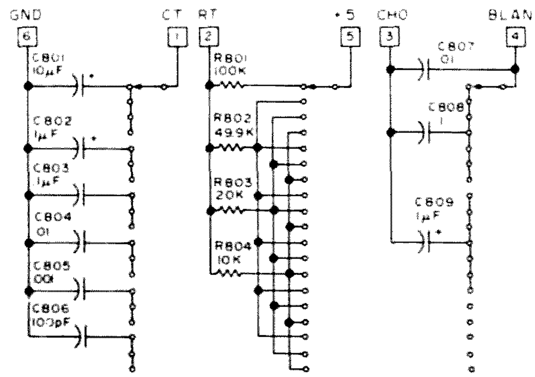


Fig. 16. Timebase switch schematic.

Winding the LVPS Transformer

Oh! oh! . . . (you knew there was a catch in this project somewhere). Not really – it's easy to wind this one! First off, you'll need a core. Best choice is a ferrite cupcore: It's easy to wind, and efficient. Pick one that's about 1¼" diameter x 1¼" high, with a bobbin. Winding area cross section of at least 3/8" x 3/4" is necessary. Best efficiency is attained with either T-26 or N-22 type cores (usually stamped right on 'em).

If you can't find a cupcore, a tapewound toroid is as efficient, although just a bit more difficult to wind. I've found that 1-3/8" o.d., 3/4" i.d. is ideal. Ferrite toroids generally don't work too well, but if you want to test one, wind a quick primary and feedback, hook it up, and try it. If you get a good square wave . . . come to think of it, you need the scope to see that . . . so simply monitor the transistor temperature for a minute or so; if they get more than lukewarm, the core is not suitable.

Bottom of the pile, but still adequate is the lowly E-I laminated audio transformer. Pick a 2 x 2¼ x ½ core (or larger), and test it as described for the toroid.

After selecting the core, cut strips of plastic bag (cupcore and E-I), or vinyl electrical type (toroid) for insulation between layers. Also cut 10 to 15 one inch pieces of Scotch tape, and 4 three inch pieces of small spaghetti. Use a hand drill to wind the bobbins, or a popsicle stick for the toroid.

Wind the HV secondary first (Fig. 23), insulating between layers. If you're using the cupcore or E-Is, leave a 1/16" space on each end of the layers. Spaghetti the flyleads, and

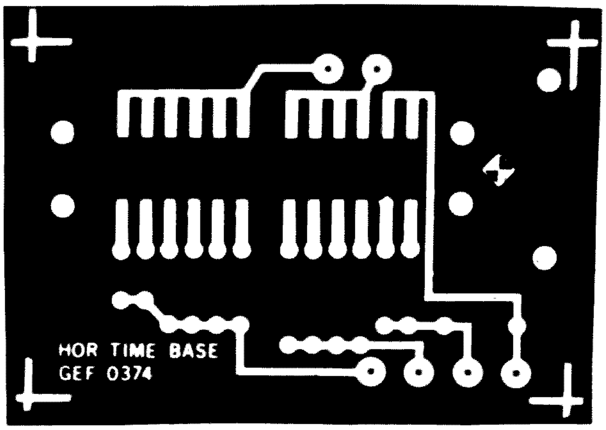


Fig. 17. Timebase switch PC board (full size).

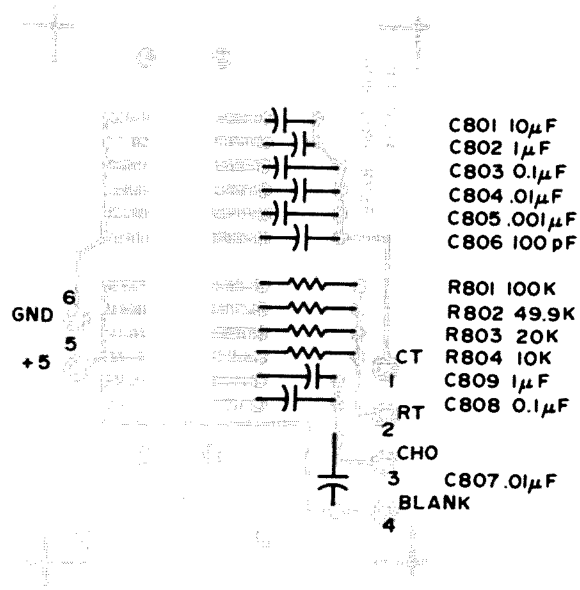


Fig. 18. Timebase switch component layout.

cover the HV winding with a double layer of poly-bag strip, securing with Scotch tape.

Next comes the CRT filament winding. This one's got to have a good insulation, so run the spaghetti into the layer and secure with tape. Cover the winding with 2 layers of insulation, secured with tape.

Wind on the two remaining secondaries (bifilar saves time), insulate and secure. Mark each flylead. Finish up with the primary (bifilar wound) and feedback windings. Mark *start* ends of each, and wind both in the *same* direction. Secure, and finish up with a layer of vinyl tape. Assemble the bobbin and core (cupcore and E-I types), and set aside. Sounds tedious, but it'll only take an hour or so. That's one of those jobs you'll get wound up in, right to the core.

Selecting Primary Electronic Parts

On to more interesting tasks. You now have enough information to select the larger electronic parts, such as switches, pots and the HV transformer. Remember that most all parts of your scope are quite non-critical (exceptions are marked), so some thoughtful scrounging here can save you money! Use the services of the many surplus houses, some junk box parts, etc., and you'll be amazed at the savings!

All parts of your scope may be standard items, or you may want to try some of your own design. My scope makes use of a home brew cam-type switch for vertical attenuator and timebase, primarily to save space. The photo illustrates the basic construction of this type of switch. However, there are several alternate approaches.

Use standard switches with a similar number of positions, if you have the space. Note that by slightly changing the timing resistors, you can come up with a 1-3-10 sequence, which saves many switch positions, making for a smaller switch. Values for the 1-3-10 resistors are listed under switch options in the parts list.

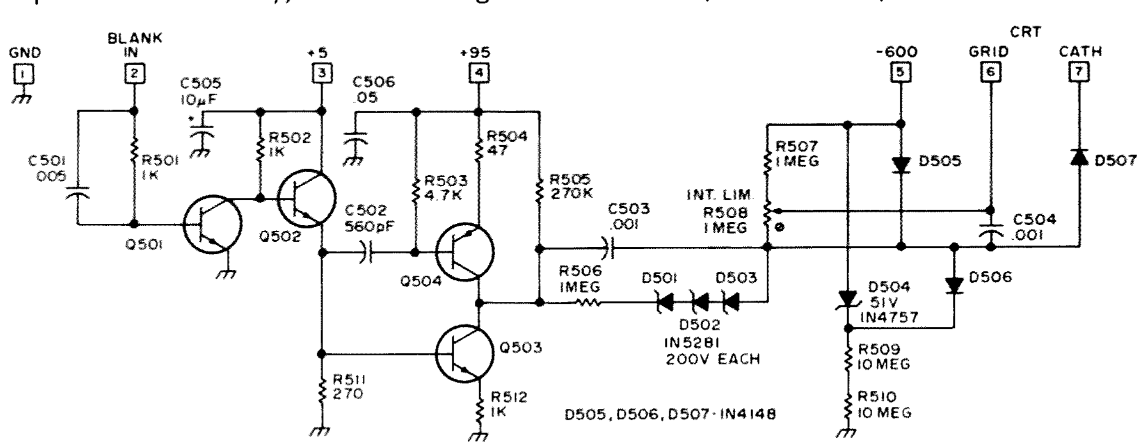


Fig. 19. Blanking schematic.

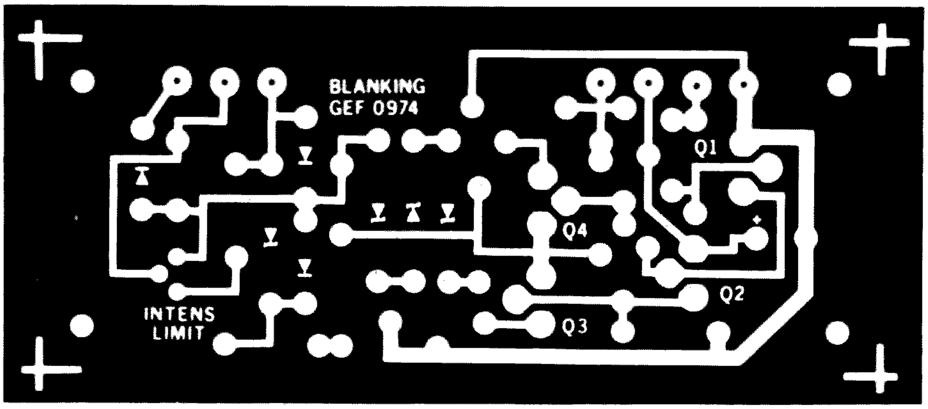


Fig. 20. Blanking PC board (full size).

The HV transformer specified is an old friend to phone-patchers, 22k, 5.2k and 600 Ohm, all centertapped. The transformer is usually under a dollar, and readily available surplus. Note you'll need 2 for options 1 or 2. Making this little feller withstand 250 to 500 V constantly may seem a bit risky, but I've used more than 20 of them in various direct (no multiplication) supplies for up to 1.8 kV with only one failure. That's a whale of a lot more voltage than your scope's transformer will ever see!

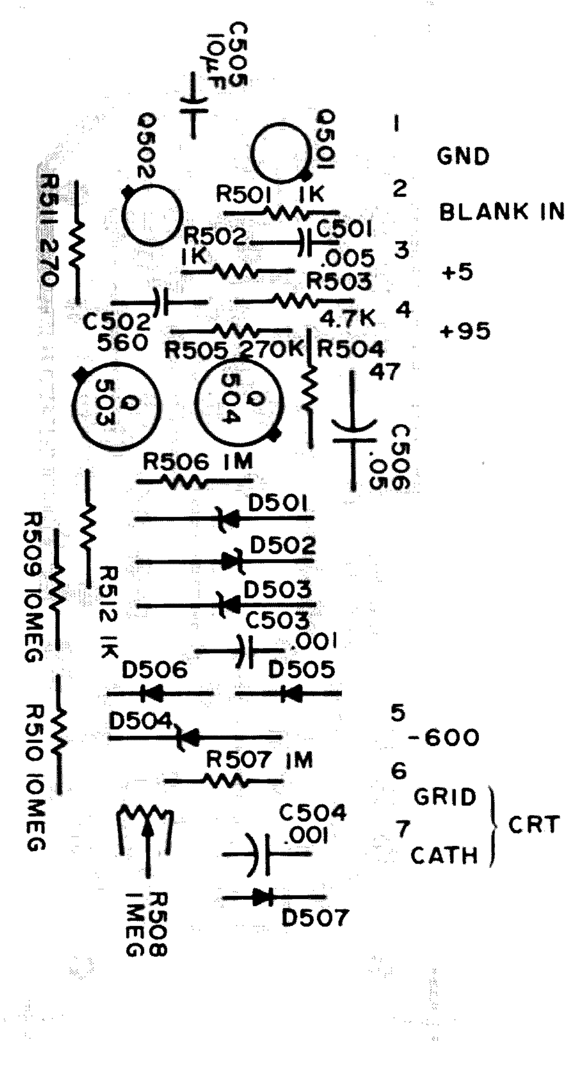


Fig. 21. Blanking component layout.

Electronic Construction

The heart of your scope is, of course, the electronics. Best, and by far the easiest, construction is afforded by PC boards; however, you may use vector, or any other suitable method. Whatever way you do it, remember that most of the circuitry operates from dc to at least 10 MHz, so use good layouts and plenty of bypasses! You may tape from the PC layouts in this article, or get full size negative prints (for photo-etching) for an SASE. Should you make your PC board by photoetch, don't strip the KPR off after etching. Solder through it, cleaning the board of rosin with isopropyl or denatured alcohol. The KPR will keep the copper bright during construction.

All components are readily available, most surplus. Even though E. Murphy says interchangeable parts won't, you should have no difficulty substituting. A few recommendations: Use solid tantalums rather than electrolytics. Use low temperature co-efficient ceramics or micas in calibrated circuits. Use ¼ W, 5% film resistors "R-Ohm". (They have only one disadvantage – you can only get them in packs of 50. But at 2¢ each, they are a far better buy than regular ¼ watters and the leftovers will certainly be a welcome addition to the junk box.) Use sockets everywhere – they make life much more enjoyable during testing later on.

PC Boards

PC board layout is such that all off-board leads terminate on one edge of the board. This makes it easy to flip the board over after cabling. Wires may be simply poked and soldered, or turret terminals may be used. The latter method is much nicer looking. By the way, there is no need to buy expensive setting dies: Simply drill a small hole ¼" deep into a ¼" diameter rod for the anvil. Use a centerpunch to set the terminals. Stuff and solder all components. Clean the rosin off with alcohol, and give the finished boards a light coat of clear Krylon.

Preliminary Testing

By now, you're feeling the unscratchable itch to see some of your handiwork do something. OK, fire up (what terminology!) the LVPS, using either a regulated power supply or the scope's batteries. Be sure to fuse the line, unless you want to really fire it up!

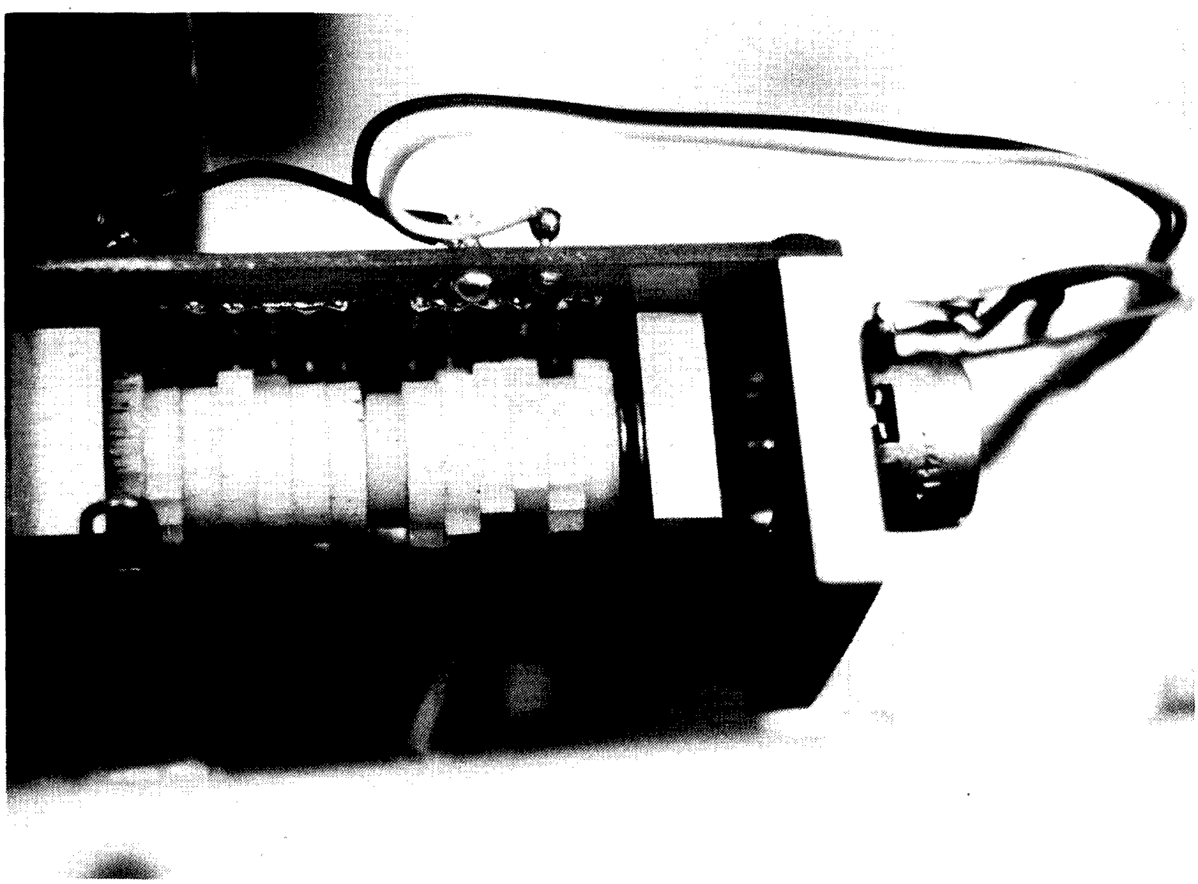
Upon connecting the 12 V dc, you'll hear the inverter, and can check +5 and −5, and set the +95. To check the CRT filament supply, cliplead your CRT across it, watching for normal filament glow after about 20 to 30 seconds. (Some VOMs dislike square waves, and won't read correctly.) Check current drain with the CRT connected – it should be 500 to 600 mA. That completes checkout of the LVPS.

The HVPS may be tested by tacking in the transformer and applying 12 V dc. A low buzz indicates normal operations. Check the high voltage carefully. An easy way to check regulation is to change VOM ranges, causing different loads; voltage reading should remain substantially constant. Remember to bleed both outputs down after testing, unless you like surprises.

The remainder of the boards are best tested after cabling is complete, so let's get at it.

Case Work

Returning to the case, arrange all your finished boards and other parts, and mark



Closeup of timebase switch. The cams are made from TV tuner gears, which press spring contact arms onto pads on the PC board. Detent spring on left end is a paper clip.

and drill all mounting holes. Make an exact template of the drilled front panel for later. Mount the boards, controls and all other parts.

Cable up your entire scope, using #24 PVC color coded or equivalent, and RG 174/U or similar well-shielded coax for all sensitive leads. Use shrink tubing to finish off the coax ends. At this point, don't tiewrap the cables. I strongly recommend the usage of three large turret terminals near the power supply section: +12, −12, and clean ground. These facilitate making neat, loop-free grounding and power connections. All board grounds should be run separately to the clean ground point. Be sure to use shielded cable for the lines to the power switch, and ground the shield to the *clean* ground.

Install your CRT and its shield carefully. Make a quick check of primary power wiring, and check for any dead shorts with a VOM.

Graticule

We will shortly need graticule, so now's the time to make one. Choose a piece of blue or green 1/16" transparent plexiglas. Get a piece large enough for two graticules, in case you make a mistake. Cut the plexiglas to size, smooth the edges, and tape it (squarely) to a piece of linear graph paper. Take a ruler, and carefully scribe lines into the plexiglas with the back edge of an X-acto knife. Scribe 10 horizontal divisions, and 5 vertical. Mount this graticule on the scope with screws or cement, whichever is appropriate.

PARTS LIST

This list should be used as a guide. As I mentioned before, the scope is insensitive to any reasonable subbing, except for the calibrated circuits. For this reason, I've supplied you with a lot of parameter data, allowing more freedom in parts choice. Hopefully this will help hold the cost to a minimum.

CRT – See the table on page 83, and the text.

Batteries – Use sealed, rechargeable cells that will supply a solid 12 V at 2 to 5 A-H.

Case – To fit. Consider such oddballs as a large chassis, the bottom plate supporting everything. Cut the ends off the chassis, trim them to fit within the chassis, and fasten to the bottom plate to form the front and rear panels. Cost about $10; not bad for a custom case!

PC Boards – Use G 10 epoxy board, and buy a square foot surplus. The local printer might give you enough KPR for the job (2 ounces). Vertical amplifier is 5½ x 2½; horizontal board, 5 x 2¼; LVPS, 4½ x 3; HVPS and blanking, 4 x 1½; vertical attenuator and timebase switches, 2¼ x 1½.

Rotary Switches – All may be phenolic wafer type, or better. One 4 pole, 10 position; one 3 pole, 20 position; and one 3 pole, 4 position.

Toggle Switches – Miniature type, available surplus for 50¢. Two DPDT, one SPDT, and an odd one that may be hard to find: C&K type 7211, with 3

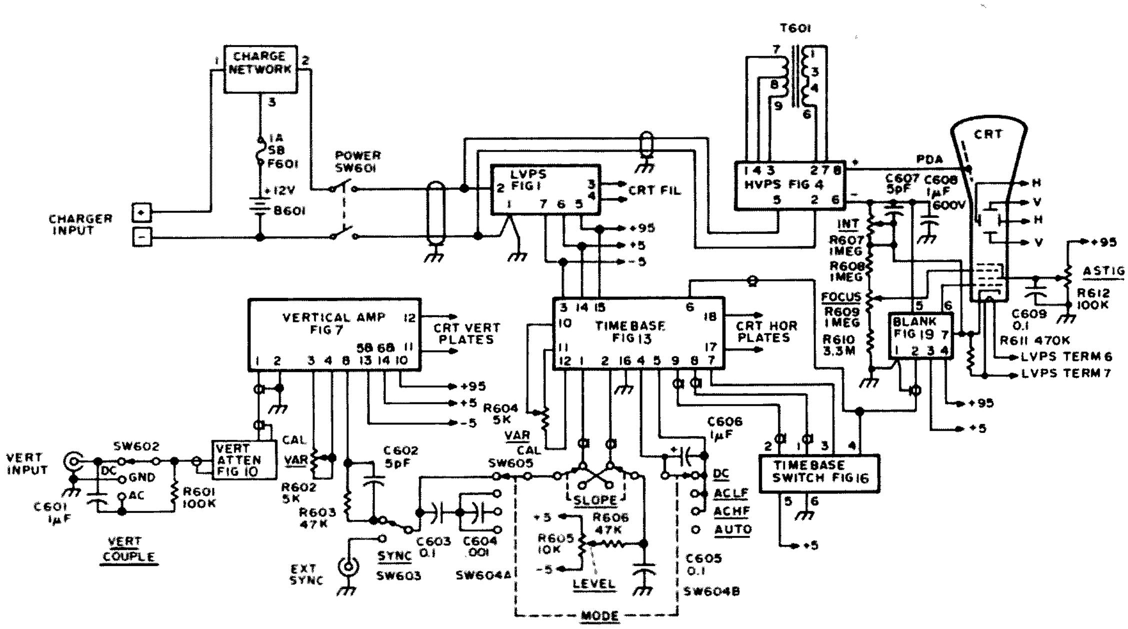


Fig. 22. Mainframe.

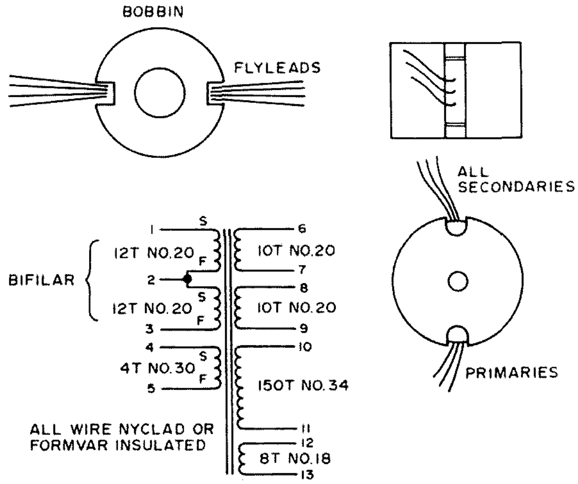


Fig. 23. LVPS transformer schematic.

ON positions. You can use a 1 pole, 3 position miniature rotary, or similar.

HV Transformer – Often marked "Lionel," it's 1x1x2 inches, with 22k, 5.2k, and 600 Ohm windings, all centertapped. Surplus goodies at a dollar.

Precision Resistors – Total of 14. Using 1% resistors will cost you about $10. However you can test the R-Ohm resistors, which will run you about 30¢, and a little time. Most of them check out well within 1½%, so you might get away without even testing them; they are essentially as stable as 1% types. Values for the alternate 1-3-10 timebase sequence are: 10k, 30k, 100k, and 300k; normal 1-2-5 values are shown in Figs. 10 and 16.

Timing Capacitors – You need six: 100 pF and .001 uF may be mica or zero-TC ceramic; .01 uF through 10 uF should be miniature tantalums (TAG or similar) for best stability. Tolerances seem high for this usage, but the tantalums usually end up quite close to marked value.

Active Components – Part numbers given have all been used in the scope, and work well. Except for rare instances (*), the circuits seem content with nearly any reasonable sub.

Q303, 305, 307, 309, 405, 408, 503: RCA 40594, or 2N5320 (V_{ceo} 95 V min, f_T 50 MHz min);

Q304, 308, 406, 409, 504: RCA 40595, or 2N5322 (V_{ceo} 95 V min, f_T 50 MHz min);

Q302*, 306*: 2N918, 2N5179 (f_T *must* be greater than 500 MHz);

Q301: 2N3954 through 2N3958 (must be *monolithic* dual FET);

Q101, 102: GE type D40C6, or RCA 2N5294 (V_{ceo} 40 V, I_c 4 A);

Q103: 2N3440 (V_{ceo} 200 V min, 1 Watt NPN);

Q203*, 402*: 2N4302 or 2N5457 (IDSS 2 to 3 mA);

Q201, 202, 204: 2N697, 2N2219 (40 V, 5 Watts NPN);

All remaining NPN: 2N697, 2N2222, 2N2219, 2N718, 2N6002 (any HF silicon NPN);

All remaining PNP: 2N1132, 2N6003, 2N2905 (any HF silicon PNP);

A301: uA733;

A401: CA3046/3086 or LM3046/3086;

A402: NE555 (Signetics);

REG 101, 102: 7805 (Fairchild or Motorola);

BR 101: MDA-920-4 (Motorola), or fittable equal;

BR 102, 103: MDA-920-3 (Motorola), or fittable equal;

D205 through D210: Preferably 1N5060 series, as they are avalanche protected; 1N4005 and HEP 170 are OK, but will not take a Murphy screwdriver treatment;

Zeners: 1N47XX series is recommended; however, any good 1 Watt type is fine. Voltage ratings are on the schematics.

Capacitors — Below 1 uF use ceramic or mica; above 1 uF use "TAG" type tantalums. Values are non-critical. Multiplier capacitors in the HVPS are 0.1 uF, 500 V Sprague or CRL ceramics.

Trimmers — All are 3.5-13 pF, ¼" dia. ceramic, with 3 pins (two are common), and no name. Most end up adjusted to midrange, so you can juggle the end values a bit. Surplus is a must on these, as new price is out of sight.

Resistors — Highly recommended are "R-Ohm" ¼ Watt film resistors. You have to buy 50 at a whack, but 2¢ each makes them mighty attractive!

Pots — Surplus, military type is your best bet here. For the most compact construction, use the ½" dia. kind.

Calibration Pots — Beckman 62 and 82 series were used; however, any correct resistance ¼" dia. pot is fine. CTS and Weston also make them. Also consider Beckman series 91, a 39¢ cermet; it's a little bigger, but will fit.

Mechanical Items — Following is a potpourri of hardware found to be useful in construction. Look for similar items that will fit your scope's needs.

Turret Terminals: Cambion 3563-02 (for PC boards);

Spacers: ¼" dia., ¼" long, tapped 4-40 (PC board mounts);

Rod: .125 dia., about two feet (shaft extensions for focus and intensity); steel or brass is fine;

Couplings (2): Insulating type, .125 shaft (for intensity and focus controls);

Magnetic Shield: To fit your CRT; try to get surplus, or get a little of the bendable foil and form-fit it;

Knobs: Bet you forgot 'em! Get dressy ones;

Heatsinks: Thermalloy 6107B-14 (4 needed), and one Wakefield NF-204; all are in the LVPS; painted aluminum scraps are OK.

Next month: Testing and calibration.

. . . WØACR

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Predicting Third Order Intermod

Since the beginning of channelized FM, the problems of 3rd order intermodulation distortion have become of major importance to the VHF operator in the heavily populated metropolitan areas. The problem of intermodulation distortion is not a new problem. It has always been with us but has not been dealt with sufficiently since analysis has been complicated and ineffective. The procedure which follows deals with the understanding and analysis of 3rd order intermodulation distortion using a method called the intercept point.

Simply stated, intermodulation distortion is caused by signals from other transmitters in band which mix somewhere in the receiver and produce interfering signals. These mixing products in the case of third order intermodulation are related to the interfering signals by the relationship $2f_1 - f_2$ and $2f_2 - f_1$, where f_1 and f_2 are the two unwanted in-band signals. These new frequencies are properly referred to as third order intermodulation distortion products (IM). The two input signals will mix and produce two additional unwanted frequencies within the receiver. Once generated they remain in the system. The problem must be solved at the point of mixing. There are other products present but only the 3rd order products will be analyzed here since they are the most troublesome.

Fortunately, the problem is not as complicated as it appears. Most of the intermod is generated because the designer uses a marginal device, or chooses a good device and biases it improperly. For example, he may choose a transistor and bias it for the lowest possible noise figure and accept the resulting gain compression, or non-linearity of gain. This non-linearity of gain is responsible for the generation of spurious responses which we shall see later. The gain compression describes the useful dynamic range of a device at the high end, just as the noise figure describes the useful range at the low end.

Third Order IM

The photo shows what happens when two signals of equal amplitude are fed into our test amplifier. Each signal has a power level of −60 dBm. The two larger signals, f_1 and f_2, are at 145.5 MHz and 146 MHz, respectively. When fed into our amplifier, two new signals are generated. Both signals are 50 dB below the two main signals for a given input power of −60 dBm.

The first signal on the left is at 145 MHz and is generated by $2f_1 - f_2 = (2)(145.5) - 146$. The last signal on the right is at 146.5 MHz and was generated by mixing $2f_2 - f_1 = (2)(146) - 145.5$.

Remember that these two new signals are not present in the air. They were generated by the mixing action of the amplifier when

the two signals of 145.5 MHz and 146 MHz were injected into the amplifier simultaneously. Considering all the transmitters on the air in a given area, it is not a wonder that your receiver sometimes acts strange. Rather than try to calculate all the possible combinations of signals that may be bothering you, it may be wise to consult one of the many computer readouts available. One of the best appeared in *73* in April, 1971, by W6YAN.[1]

Understanding Gain Compression

The more linear a device, the less is the chance of generating IM. The graph of Fig. 1 is a log-log plot of input versus output power for an rf amplifier stage with 20 dB of gain. The graph shows that for an increase in input power the output should increase accordingly. Let us assume that we increase the input power by 3 dB; then the output should also increase by 3 dB. As long as this relationship is maintained, the amplifier is said to be linear. The point of non-linearity is referred to as the 1 dB compression point. This point can be found on the graph as that point where increasing our input signal by 3 dB only causes a 2 dB increase in power output.

So far, we have determined the mathematical relationship of the IM and have observed the IM products. We have defined gain compression and briefly singled it out as a major cause of IM. In the next few minutes we shall see how to accurately predict IM.

The Intercept Point

Electronic engineers in the communications field have for years used a method to accurately classify and predict the IM in amplifiers and mixers. This method is called the intercept point. The first mention of the intercept point is in an article from *Electronic Design* in 1967 upon which I have drawn heavily.[2] The original work on this concept as far as I can determine seems to have been developed at Avantek. The intercept point is a fictitious point. In actual measurement concept, the intercept point is that point at which the extrapolated linear portion of our gain plot intercepts with a plot of our IM. The gain plot is extrapolated because at high levels it deviates from a straight line because of gain compression.

The plot of Fig. 2 shows a pair of straight lines plotted on a log-log scale. It is an expansion of Fig. 1, which showed the gain plot and its compression. The third order line has been added. This line indicates the relative strength of the internally generated responses or IM for any given power input.

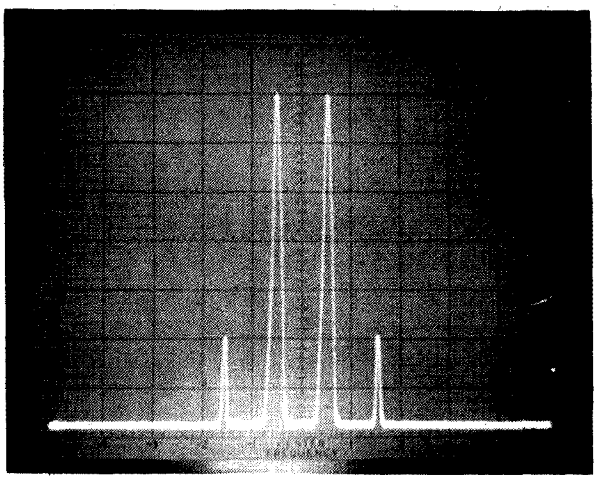
In actual laboratory practice, the third order IM is measured at some convenient power level using a spectrum analyzer, Fig. 4.

Referring to the photograph, we observe that the IM products are 50 dB below the fundamental signals for two signals of −60 dBm input. In Fig. 2 the distance from the fundamental line down 50 dB for a −60 dBm input signal has been plotted and this distance labeled "X".

The intercept line can be drawn horizontally across the graph at a point one-half times from the −60 dBm input signal. The point at which the intercept line crosses the fundamental gain line is the intercept point.

The third order IM line can now be drawn so that the measured point and the intercept point form a straight line. When talking about the intercept point it is common usage to refer to the output intercept point. It is possible, and sometimes convenient, to specify the amplifier performance in terms of its input intercept point.

For all practical purposes, our plot is complete. We can now predict what the IM will be for any given input signal. (Example: For two input signals of −80 dBm, third order IM is 90 dB below the carrier.)



Third order IM 50 dB down. F1=145.5; F2=146; F1 and F2 at −60 dBm input.

If you stare at Fig. 2 long enough, you will realize that by changing the input level by 1 dB the IM will change by 2 dB. Our original measurement produced an IM of 50 dB down for 2 signals of −60 dBm input. Therefore, by decreasing our input signals 20 dB to a new level of −80 dBm, we have improved our IM products by 40 dB and our new level is 90 dB down for 2 signals of −80 dBm input.

Rule Of Thumb

In the absence of a spectrum analyzer, a reasonable and accurate plot of the third order IM products can be obtained by assuming that the intercept line is approximately 8 dB to 15 dB above the 1 dB compression point with 10 dB being a good guess. This assumption will produce an error of 2 dB for each 1 dB we are off in our assessment. Care must also be used in making the 1 dB gain compression measurement for the same reason.

After carefully measuring the 1 dB compression point of the amplifier, plot the gain line on your graph and note the 1 dB point. Approximately 10 dB above the 1 dB point, draw a horizontal line across the graph. We are now reconstructing Fig. 2 backwards. From the horizontal intercept line note the number of dB to the gain line at any input signal level you choose. For this same input level plot a point twice that number of dB down from the gain line. This is the amount of 3rd order intermodulation distortion in your amplifier at the input level you have chosen. You now have one IM point on your chart and the intercept point and can now draw a straight line between these two points and complete your graph.

Unequal Signal Levels

Almost all manufacturers of rf amplifiers now include the intercept point as part of the data on the spec sheet. As we have just seen, the intercept point is measured using two signals of equal power. Unfortunately, this is usually not the case in an actual system. One signal is likely to be from a strong nearby transmitter and the other from a source quite a distance away. When the amplitudes of the two signals are known and they are not the same power level, they can be converted to two signals of equal amplitude quite simply. In this case, take the stronger of the two signals and subtract from it one-third of the difference between the two signals. This calculation equalizes the two signals and generates the same worst case IM as the two unequal signals.[3] (Example: One signal is at −40 dBm and another at −70 dBm. The difference between the two signals is 30 dB. One-third of 30 dB is 10 dB, which when subtracted

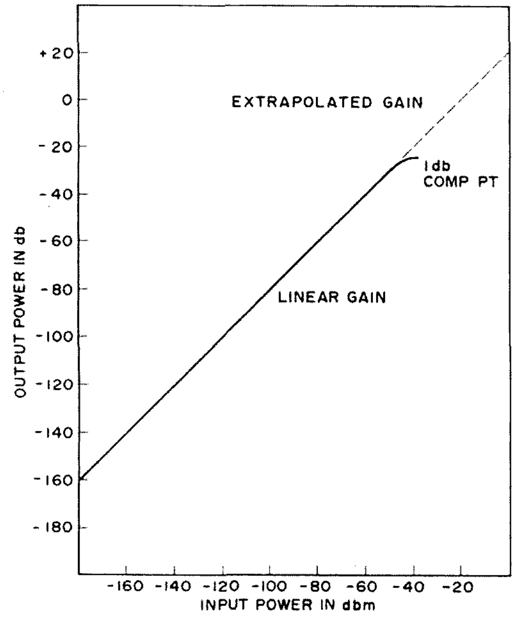


Fig. 1. Linear gain and the 1 dB compression point.

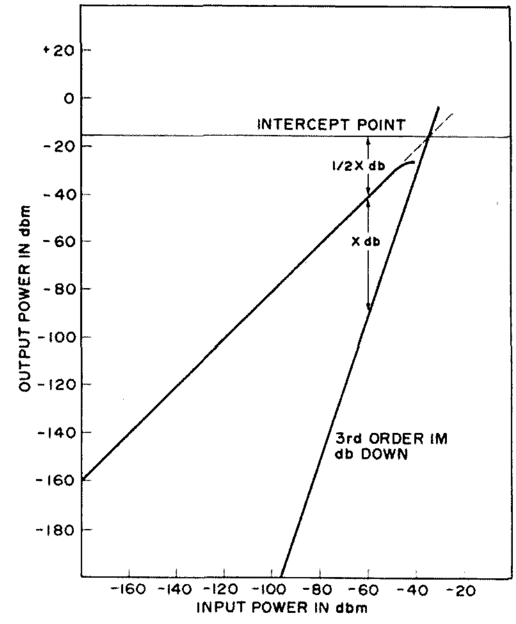


Fig. 2. 3rd order IM vs input power using the intercept point.

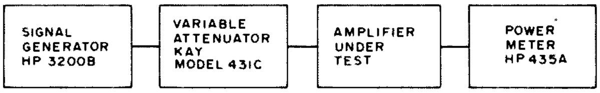


Fig. 3. Test set-up to determine amplifier 1 dB compression point.

from −40 dB yields an equivalent of two equal signals of −50 dB.)

Additional Calculations

There are still many amplifier manufacturers who do not use the intercept point and simply specify the 3rd order IM as being so many dB down for a given two signal input level. When using this type of data, it is convenient to be able to convert to the intercept point quickly without resorting to the graphical analysis. Presented here are some formulas which have been derived from the graphical analysis. They may be used by themselves or as an aid in preparing a graphic presentation. The pertinent terms are the input intercept point or IIP, the output intercept point or OIP, the amplifier gain, and the third order IM for a given two signal input.

$$\text{IIP} = \tfrac{1}{2}\,\text{IM} + \text{Signal in}$$

$$\text{OIP} = \text{IIP} + \text{Amplifier Gain}$$

Combining these two equations

$$\text{OIP} = \text{Amplifier Gain} + \tfrac{1}{2}\,\text{IM} + \text{Signal in}$$

By rearranging these terms the IM can be calculated directly.

$$\text{IM} = [\text{OIP} - (\text{Amplifier Gain} + \text{Signal in})] \quad (2)$$

Remember that the OIP is approximately 10 dB above the 1 dB compression point. Therefore if only the 1 dB compression point is given, the problem may still be solved by substituting the 1 dB compression point +10 dB for the OIP.

Analyzing Your IM Problem

From all our observations, we can see that if IM is a problem, one or more of the transistor stages is probably operating with a low 1 dB compression point. The obvious solution is to try to make the transistors run as linearly as possible and raise the compression point. As I stated earlier, many transistors are biased for lowest noise figure and the resultant gain compression is accepted. If the transistor is not being operated near its maximum power dissipation, a little more collector current might do the job. Be careful not to over dissipate the transistor. A better choice would be to choose a new transistor, one which is capable of higher linear output power. Some of the new CATV devices work great, because they were designed for low IM and good noise figure.

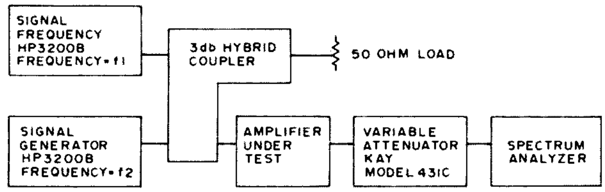


Fig. 4. Test set-up for 3rd order intermodulation distortion measurements. Note: It is very possible to overload the spectrum analyzer and generate intermodulation distortion in the analyzer itself. It is therefore a good idea to include an attenuator between the amplifier and the analyzer. Always use the lowest possible signal level to the amplifier to generate IM when making this measurement.

A good project would be to collect as many data sheets as possible on devices which might be useful at your frequency of interest and compare the optimum NF and required current. Some types such as the 2N5109 are specified as 3 dB max. noise figure at 200 MHz with 10 mA.

> **Somewhat higher priced types (MS-175, K6001) will give 1.5 dB NF at 15 mA at 150 MHz. In a feedback amplifier, gain is 15 dB and the output compression point is over 20 milliwatts. At 2 mW out, that is, two two-milliwatt signals the in-band intermodulation product (third order product) is more than 40 dB down. Such an amplifier is still operating with good linearity when succeeding stages are overloading, and therefore, there is little point in worrying about how to further improve the first stage.[4]**

I have quoted the above paragraph because it sums up nicely everything that I wanted to say and includes a fine problem. All the information needed to complete a graph of the IM plot is present. The gain at 15 dB for our gain line and the 1 dB compression at 20 mW or +13 dB out. If we again assume the intercept point line to be approximately 10 dB above our 1 dB com-

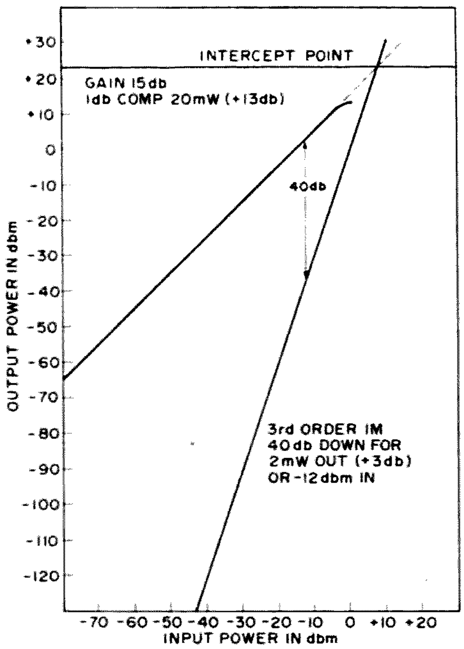


Fig. 5. Solution to IM problem given in text. Note: This graph has been plotted using the information quoted in the text. The only assumption made was that the intercept point was 10 dB above the 1 dB compression point. The graph shows that the amplifier has an output intercept point of +23 dBm or an input intercept point of +8 dBm.

pression point, we can plot a graph of third order IM products and see that the results agree favorably with the IM statement given at an output level of 2 mW or +3 dB. When analyzing this problem remember that the IM statement given was for an output level of 2 mW or +3 dB. So as not to confuse things, it might be easier to work with an input level of −12 dBm, which is the input level required to give an output of +3 dB in an amplifier with 15 dB of gain.

Comparing Two Amplifiers

With the formulas derived from the graphical analysis we can now compare amplifier performance. The amplifiers of Figs. 2 and 5 can now be compared quickly since both have been characterized by the intercept point. The input level I have chosen is for a signal level of −73 dBm or 50 microvolts. In the old day of AM this represented an S9 signal and I suppose it is as good a place as any to establish a reference input. The data we need to work with is only the amplifier gain and the intercept point. Since we have graphed both amplfiers, we can look up the IM on the graph at the −73 dBm input point or we can solve the problem mathematically, assuming that the manufacturer has provided the intercept point.

Fig. 2.
AMPLIFIER SPECIFICATIONS
Gain = 20 dB
OIP = −15 dBm

Fig. 5.
AMPLIFIER SPECIFICATIONS
Gain = 15 dB
OIP = +23 dBm

Problem: Calculate 3rd order IM at input level of −73 dBm.
Solution:

Fig. 2.

$$IM = [OIP - (Gain + Signal\ in)]\ (2)$$
$$= [(-15) - (20) + (-73)]\ (2)$$
$$IM = 76\ dB\ down$$

Fig. 5.

$$IM = [OIP - (Gain + Signal\ in)]\ (2)$$
$$= [(+23) - (15) + (-73)]\ (2)$$
$$IM = 162\ dB\ down$$

(Note: Fig. 5 must be expanded to read this IM value.)

There is no contest in this case and the amplifier of Fig. 5 wins easily.

Assuming that your receiver is ideal and generates no IM, let's see what happens when the preamplifier of Fig. 2 is placed ahead of the receiver. First, the two input signals of −73 dBm are amplified by 20 dB, which is the gain of the amplifier. The signals at the output of the amplifier are now −53 dBm, which is applied to the receiver input. In addition, the IM generated in the amplifier is 76 dB below our −53 dBm output signals or at a signal level of −129 dBm. This would be a very marginal amplifier since most good receivers can begin to hear at −129 dBm or .08 uV. Remember, we are analyzing this system at a 50 uV input level so signals of 20 dB over S9 could easily cause problems. The fact that we have added 20 dB of gain to our system will probably cause IM to be generated further on down the receiver. These solutions can therefore be carried through a receiver right through the i-f stages. If you do decide to improve the intermod don't get carried

away. It usually takes two people to solve these problems — one to do the actual work and another to tell him when to stop.

Conclusion

The same procedures can be used to accurately predict other orders of IM and are dealt with in the references.

Even if you decide not to dig into your receiver (a very wise move) and try to lower its IM, I hope that this article will help you next time you compare amplifier specifications.

When writing to amplifier manufacturers for data, ask them to specify the intercept point. You can then graphically analyze the amplifier and pick the one which suits you best. Remember, an amplifier with a lower noise figure will not make operating any easier if it adds IM to your system.

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Feedline Primer

No matter how carefully we try to arrange our station, it's next to impossible to put the antenna and the transmitter in the same place. As luck would have it, antennas must be high off the ground, and clear of surrounding objects that might dampen their power, while the transmitter is usually put indoors where it's convenient to use. The solution to this problem is to use a "transmission line" which is designed to carry the radio-frequency power from one particular place to another.

Ideally, a transmission line should be able to transport power over any distance without letting any escape, but at radio frequencies a wire acts quite differently than it does at the 60 Hz power-line frequency, and it's this difference that makes transmission line more lossy and complex than ordinary wire.

The difference is related to the fact that at 60 Hz a wavelength of wire is on the order of 3100 miles, so that a 100 mile length of line is only an insignificant 1/31st of a wavelength, but at 30 MHz (10 meters) a 100 foot feedline is nearly 3 wavelengths long. Consequently, as discussed later, very different things can be happening at various points along the line. Because of this, the line can begin to lose power, which means that less power will reach the antenna than should.

Before we start, though, it might be a good idea to describe what the ideal line would be like. The ideal "infinite line," as it's called, consists of two perfect conductors placed side-by-side and extending on into infinity. At any one time, the polarity of the current in the first conductor is exactly opposite that in the second conductor. In other words, the two currents are 180 degrees out of phase. As a result, if any radio-frequency energy is lost by one of the conductors, it will be opposite to that lost by the other conductor, and the two fields will cancel each other out. To cancel completely, both losses must be equal in amplitude (the same strength) which would only happen if the two wires occupied *exactly* the same spot in space. Since this cannot take place, there will always be some loss from any line. However, these losses will be negligible so long as the two conductors are spaced at less than 1/100th wavelength.

Characteristic Impedance

In our infinite line, the characteristic impedance, sometimes called "surge impedance," is roughly equal to the square root of the ratio between line inductance and capacitance:

$$Z = \sqrt{L/C}$$

The inductance, while small, is due to the fact that the wire sets up a magnetic field

around itself, which in turn induces a current back on the wire that is opposite in direction to the existing current flow. This results in cancellation, the total effect being that of inductance. The capacitance is due to the separation of the two conductors (which act like the two plates of a capacitor), by some type of dielectric such as air, or plastic insulation.

The capacitance, inductance and impedance of a particular line will depend upon the distance between conductors, and their size. The larger the conductors and the closer their spacing, the lower the inductance and the greater the capacitance, and vice versa. A high impedance line will have small conductors widely spaced, while a low impedance line will have large conductors closely spaced. In the infinite line, this impedance is purely resistive, but in a real line there will be some reactive component due to inductive and capacitive effects. It might be noted that characteristic impedance determines the amount of rf current that can flow for any given voltage. Consequently, as the impedance decreases, a higher current will flow for any given power level.

The Practical "Matched" Line

The practical line (one that can really be built) will only try to act like an infinite line if it is terminated by a pure resistance equal to the line's characteristic impedance. If this condition is satisfied, then the line is said to be "matched." In other words, the line acts just like an infinite line delivering all its power to a load (the resistance). In practice, the load would be the antenna, which would radiate all the power presented to it. Consequently, to the radio wave the load only looks like a continuation of the line because it has the same resistance as the line does. In addition, under matched conditions the line's actual impedance (that which can be measured, and is really there) will be equal to its characteristic impedance (that which should be there). As we will soon see, this is

Table A

Attenuation in dB/100 Feet

Type	3.5 MHz	7 MHz	14 MHz	21 MHz	28 MHz	50 MHz	144 MHz
RG-58/U	.78	1.1	1.7	2.2	2.5	3.5	6.3
RG-8/U	.30	.45	.66	.83	.98	1.35	2.5
RG-59/U	.60	.90	1.3	1.6	1.9	2.7	4.8
RG-11/U	.35	.55	.80	.98	1.15	1.5	2.3
Twin-Lead	.19	.28	.41	.52	.60	.85	1.5
Open-Wire	.03	.05	.07	.08	.1	.13	.25

Table B

Type	Impedance	Velocity Factor	30 MHz Power Rating
RG-8/U	52	.66	1700 Watts
RG-58/U	53.5	.66	430 Watts
RG-11/U	75	.66	1400 Watts
RG-59/U	73	.66	680 Watts
RG-17/U	52	.66	5600 Watts
Twin-Lead	300	.82	-----
Open-Wire	-----	.95	-----

Fig. 1. In Table A, attenuation figures may vary from manufacturer to manufacturer. In Table B, the open-wire line impedance will vary depending upon conductor spacing. Wattage capacities of parallel conductor line will depend upon wire size and conductor spacing, there being no "standard" size open-wire line, but many differently built types.

Additional Loss Due To swr
(In dB)

	swr 1.5	2.0	3.0	4.0	5.0	7.0	10	15	20
.2	*	*	.13	.22	.30	.48	.7	1.2	1.5
.3	*	*	.18	.3	.42	.63	1.0	1.6	2.0
.4	*	.1	.23	.38	.54	.85	1.25	1.9	2.5
.5	*	.13	.27	.47	.65	1.0	1.5	2.3	3.0
.6	*	.14	.32	.54	.75	1.2	1.75	2.6	3.3
.7	*	.15	.36	.6	.85	1.3	2.0	2.8	3.6
.8	*	.18	.4	.69	.95	1.5	2.2	3.0	3.9
.9	*	.19	.45	.75	1.1	1.6	2.3	3.3	4.0
1.0	*	.2	.5	.82	1.2	1.7	2.5	3.5	4.3
1.5	*	.26	.67	1.2	1.5	2.2	3.0	4.3	5.1
2.0	.1	.3	.8	1.3	1.8	2.5	3.5	4.8	5.8
2.5	.13	.35	.9	1.5	1.9	2.8	3.8	5.1	6.0
3.0	.14	.39	1.0	1.55	2.0	3.0	4.0	5.3	6.5
4.0	.15	.41	1.05	1.7	2.3	3.3	4.3	5.8	6.8
5.0	.16	.45	1.1	1.75	2.4	3.4	4.5	6.0	7.0
6.0	.17	.48	1.15	1.8	2.5	3.5	4.6	6.2	7.2
7.0	.18	.49	1.2	1.8	2.5	3.5	4.8	6.4	7.4
8.0	.18	.5	1.2	1.8	2.5	3.6	4.9	6.5	7.4
9.0	.19	.5	1.25	1.9	2.5	3.7	4.9	6.5	7.5
10.0	.19	.5	1.25	1.9	2.5	3.7	4.9	6.5	7.5

*Additional loss is less than .1 dB.

Fig. 2. Find the loss for your cable from Fig. 1, and then locate the nearest dB figure in the left column of this table. Follow that line to the right until you reach the proper vertical column for the swr you have. At this point is the additional loss figure.

not always the case, especially when the line is mismatched.

Standing Waves On A Mismatched Line

As pointed out above, if the line is terminated in a load having the same resistance as the line's characteristic impedance, just about all power is delivered to the termination. But suppose that the load is a different value? In this case, some of the power is reflected backward down the line. This may be visualized by picturing water flowing through a six inch pipe which represents the line. If the pipe is coupled through a reducer to a three inch pipe (representing the load), pressure would be higher in the three inch pipe than in the six. As a result, water would flow backwards at the junction as the pressure tries to equalize. Because of this, both *forward* going and *reflected* power will be present along the line. In some places this power will cancel, while in others it will reinforce, thus causing peaks and valleys (referred to as antinodes and nodes) in the voltage and current distribution. The actual voltage or current at any one point will be equal to the sum of the forward and reflected voltages, or currents, found at that point. Consequently, as you move along the line, if the voltage could be measured, you would find that readings would vary up and down at equal distances coinciding with the maximums and minimums resulting from the sum of the two opposite currents. In a perfectly matched line, the voltage and current will be constant along the line's length because there is only one current traveling through the transmission line, so there is nothing for it to reinforce with.

Since the peak voltage found on a line is related to the severity of the mismatch, the ratio of maximum to minimum voltage is used as an indication of how well the transmission line is matched to the load. Current may also be used in this manner. This is called the "standing wave ratio" and it may be expressed either as swr = V_{max}/V_{min} or swr = I_{max}/I_{min}. In a perfectly matched condition, the maximum voltage or current will be equal to the minimum, so the ratio is equal to 1. This is

the "ideal" condition that most hams shoot for, but an swr of anywhere from 1.05 to 1.5 is often considered to be hard enough to obtain, and certainly good enough for most people.

Swr may also be expressed as a quotient between the impedance of the load, and the impedance of the line with the numerator of the fraction being the larger of the two numbers (swr = Z_o/Z_r, or swr = Z_r/Z_o. Z_o = characteristic impedance, Z_r = load impedance). Because the largest number is customarily put on top, the swr can never be less than one.

Since it is easier to measure than either impedance, capacitance or inductance, swr is used more commonly in determining just how well lines are matched. In the average shack, a reflectometer is used to measure the forward and reverse voltages on the line. From these voltages the swr is then calculated by using the equation swr = $(V_o+V_r)/(V_o-V_r)$, in which V_o = forward voltage, and V_r = reverse voltage. Notice that the sum of V_o and V_r will be the maximum voltage that can appear anywhere on the line, and V_o-V_r will be the minimum voltage, so we are back to our original equation, swr = V_{max}/V_{min}. Lest this look like an awful mess to tackle each time you want to find out what your swr is, most reflectometers (swr bridges) have a calibrated swr scale to eliminate the nuisance of repeated calculations.

Input Impedance of Mismatched Lines

As mentioned earlier, the impedance of a line that is perfectly matched to the load is equal to the characteristic impedance of the line. Consequently, a transmitter operating into the line's "input" side would see an input impedance equal to the characteristic impedance. On the other hand, if standing waves are present, the input impedance may vary considerably from the expected characteristic impedance value.

The reason for this variance is the fact that the voltage and current phase relationship found at the input side of the line can change when an swr is present. This will create an impedance that is very different from the characteristic impedance of the line. Remember that impedance is equal to the ratio of voltage to current (Z=E/I) so the input impedance will change in step with whatever voltage and current there is at the input point. Since voltage is not in phase with the current, the voltage to current ratio at different points along a wavelength of line will vary. Correspondingly, since the voltage and current waveform repeats itself at intervals of one-half wavelength, the values of impedance will do the same. It may now be seen that the input impedance of a mismatched line will be very different depending upon how far the input is from the load. If the swr and line length are such that a low voltage and a high current appear at the input, then the input impedance will be lower than the characteristic impedance. High voltage and low current will result in an input impedance higher than the characteristic impedance.

In addition to causing a variation in input impedance, swr also causes it to contain reactance. This effect is present regardless of whether the load is purely resistive or reactive. The presence of a reactive component is due to the out-of-phase relationship between voltage and current caused by swr. If voltage lags current, then the reactance is capacitive; if current lags voltage, it is inductive, just as if a capacitor or inductor were connected across the line. The only exceptions to this effect are at the nodes, where the voltage and current are in phase. At these points, which appear at one-quarter wavelength intervals, the impedance is purely resistive.

Resonant Lines

Many transmitters are capable of operating into a variety of resistive impedances,

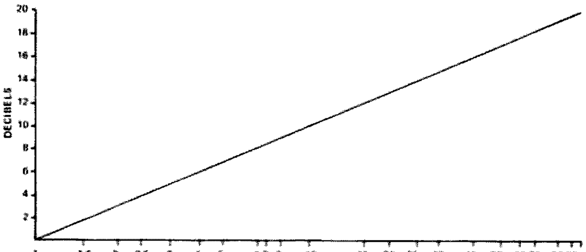

Fig. 3. Chart used to convert decibels to a power ratio. For instance, 7 dB represents a ratio of 5 to 1.

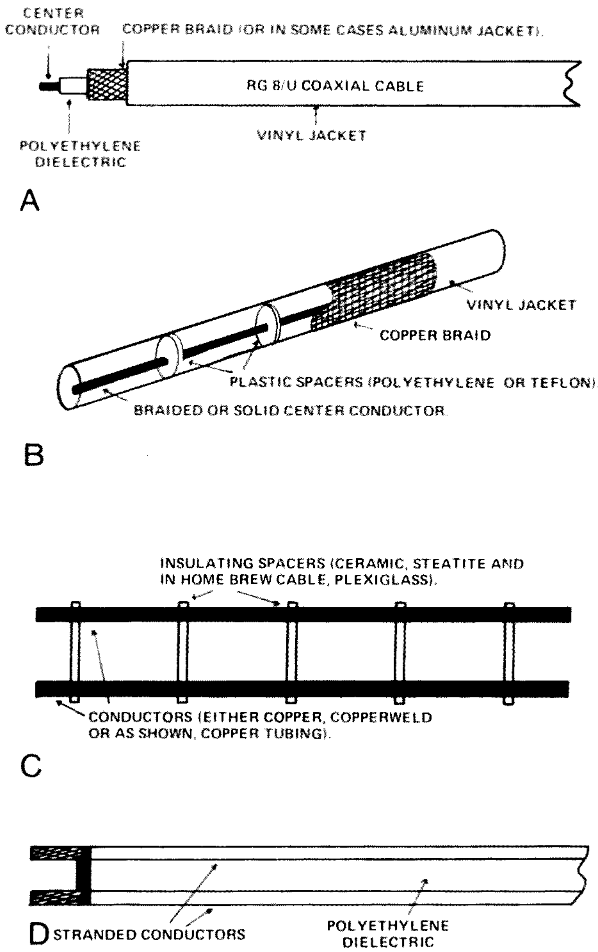

Fig. 4. Four examples of transmission line often used by amateurs.

but they cannot tolerate reactance. Consequently, it is possible to load up into a mismatched line only so long as the input is at one of the nodes. When a feedline is cut to benefit from this situation the line is said to be "resonant" or "tuned." A line with a low swr, and a fairly uniform impedance that falls close to the characteristic impedance regardless of line length, is called "nonresonant" or "flat."

A flat line is usually considered to be one having an swr of 2:1 (i.e.,2.0 or 2 to 1) or less, and can be as long as necessary. When the swr rises above 3 to 1, the line falls into the "resonant" category, because it can only be used efficiently if its length is adjusted so that the input is at a node.

As a rule, the lower the swr the better, so a "flat" line is generally the objective. In most cases, a resonant line is resorted to only if there is a bad mismatch between the

line and the load, and neither can be adjusted to straighten everything out.

Velocity Factor

In the common types of available transmission line, polyethylene insulation is used between the two parallel conductors. The plastic is used both to separate the conductors, and to keep them at a fixed distance from each other. However, the use of this insulation has two drawbacks: It causes power loss, and it reduces the speed at which power may pass through the line because electromagnetic fields travel more slowly through solid materials than through free space. This means that for the same frequency, the wavelength in a transmission line is shorter than it would be in air. In other words, the wave doesn't travel quite as far during one cycle because it has been slowed down.

Throughout this article, when reference has been made to a "wavelength" of line, it is the so-called "electrical" wavelength that has been meant. To convert from physical to electrical length, the "velocity factor" must be used. The velocity factor is the ratio of wave velocity within the line to wave velocity in free space. The equivalent physical length of a wavelength of line may be calculated by using the equation: length in feet = (984V)/F, F = frequency in megahertz, and V = velocity factor.

The velocity factors for several popular types of cable are given in Fig. 1, Table B.

Transmission Line Losses

Coming back to the perfectly matched transmission line, there are three major ways in which power may be lost: by I^2R losses in the wire (heating of conductors), by heating of the insulation (dielectric heating), and by radiation.

To a small extent, heating of the conductors is due to the inherent resistance of the wire. These are usually referred to as I^2R losses because they follow the power formula $P = I^2R$. Major heating is caused by the conductors' inductive reactance. Unlike resistance, the reactance increases with frequency, so that losses become quite considerable at high frequencies. Conductor losses also increase as the characteristic impedance decreases, because higher currents may flow for a given voltage in a low impedance line. Dielectric losses are just the opposite: They increase as voltage increases, so greater loss occurs on a high impedance line. Dielectric losses also increase with frequency.

Radiation losses, in a perfectly matched line, are due to stray coupling of rf from the antenna. This rf may be phased in such a manner as to cancel part of the existing wave on either conductor, and it is in this way that much of the loss takes place. Any additional radiation loss is caused by the small uncancelled leakage caused by the slight separation of conductors.

Swr And Line Losses

As swr increases, it is normally assumed that line losses become severe, and efficiency falls below acceptable values. As we have seen previously, tuned or resonant lines may be operated under mismatched conditions. In fact, a low swr is not necessarily all that important. Whether swr related losses are serious or not depends upon the inherent line loss under perfectly matched conditions. If the original line is air-insulated, for instance, the inherent loss is low because of the absence of a lossy dielectric, so the swr related loss is also small. However, if the line has polyethylene insulation, there is a much greater dielectric loss, hence a high swr related loss. Since dielectric and conductor losses increase with frequency, so will the losses due to swr. Consequently, an acceptable swr at 14 MHz may well be unacceptable at 28 MHz, because of increased inherent loss. For this reason, low loss air-insulated transmission line is often used to feed a mul iband antenna, which has a wide variety of swr values across different bands, so that swr related losses will be nearly as insignificant on 10 meters as on 80, no matter what happens to the swr.

When computing total line losses, take the inherent loss for the cable you are using from Fig. 1, Table B, and *add* it to the swr caused loss from Fig. 2. Accuracies in Fig. 2 are ± .05 dB for losses less than 1 dB and ± .5 dB for loss values greater than 1 dB. Remember that the inherent loss is shown in

dB per 100 feet, so the dB figure must be corrected for the length of cable you are using. For example, if you were using 50 feet of line, you would multiply the appropriate dB value by 1/2, for a 75 foot piece you would multiply by 3/4, and so on. Fig. 3 may be used to convert the dB figure into an actual power ratio.

In addition to increasing line losses, swr also affects the power handling capabilities of a transmission line. All lines will have a voltage limitation imposed by the voltage breakdown, or arc voltage for air-dielectric lines, between the two parallel conductors. The current limitation is dependent upon conductor diameter and metallic composition, and the melting or ignition point of any insulation that is used. The amount of power that can be safely handled when an swr is present is inversely proportional to the standing wave ratio (reduced power handling capacity = original capacity/swr). In other words, if the line was originally able to handle 1000 Watts, an swr of 5 to 1 will reduce this capability to 200 Watts.

Coaxial Cable

Several types of transmission lines fall into the coaxial cable group, but by far the most common is the solid dielectric type. In this form, as seen in Fig. 4, at A, a solid or stranded center conductor is surrounded by polyethylene insulation. A shield of braided copper follows, forming the second conductor, and a waterproof vinyl protective cover encircles the braid. For low power handling capabilities, the center conductor is usually #18 copper, single conductor.

Copperweld, comprising of a steel inner wire bonded to an outer coating of copper, is used to increase strength in the center conductor. However, both hard and soft-drawn copper (though more easily broken), are 7 times more conductive than steel. The only reason that copperweld can be used effectively is that at radio frequencies inductance in the wire's center will tend to force the rf into the outer copper layer, where resistance is lower. It is for this reason that cable used at high frequencies, where efficiency must be at a maximum, often has silver plated conductors. Silver is about 6%

more conductive than copper, which may not seem very impressive, but every little bit counts when dielectric and reactive losses approach 2 dB/100 feet, such as one might find at 432 MHz.

In cables intended for use at high powers (1000 Watts and above), a stranded center conductor is used instead of a solid copper, or copperweld conductor. Unfortunately, the spiraling of the stranding creates a spiraling of the rf, resulting in a longer rf path. Also, there is a higher center conductor resistance because of the contact resistance between each strand and its neighbor. This resistance contributes to a higher total attenuation in this type of cable.

As mentioned before, solid polyethylene, with a dielectric constant of 2.3, is the insulation used in most coaxial cable. The ideal cable would be an inner conductor suspended exactly in the middle of the outside conductor, with air as the only dielectric. In this case, the dielectric constant would be that of air (1.0) which is the "ultimate" (except for a vacuum) and provides the lowest attenuation. This is impossible in practice, because supporting material must be used to maintain proper spacing between conductors. Therefore, a compromise can be made between the high constant of polyethylene and the low constant of air. In some cables a foamed polyethylene dielectric having countless encapsulated air bubbles is used, resulting in a dielectric constant of 1.5 or thereabouts. With such cables, attenuation figures at 100 MHz are at least 1.5 dB better than regular cable, and even greater at higher frequencies.

Another method of lowering the dielectric constant is shown in Fig. 4, at B. During production, the areas between each spacer are filled with air so that a high percentage of the dielectric is of a low loss nature. Since this type of cable must be pressurized as it is extruded, it is more costly to manufacture and not frequently used in amateur applications. Another disadvantage is the fact that cables of this nature are not very flexible. Also, in the areas between spacers, the distances between conductors can vary, causing different impedances to be present. All of these small mismatches can add an swr of as much as 4 to 1 at some frequencies.

In most cable the shield is made up of many fine wires braided into a tube that surrounds the insulation. Since there are a large number of individual wires, there is a considerable total contact resistance. Also, the shield is not 100% efficient, because rf can leak out through small chinks between each wire. Cable is available that replaces the braid with a seamless aluminum shield having much better shielding characteristics.

Table of Coax Data

RG #	Imp.	Cap.	Max. Volts
5B/U	50	29.5	3000
8/U	50	29.5	5000
8A/U	52	29.5	5000
9/U	50	30.0	5000
9B/U	50	30.0	5000
11/U	75	20.5	5000
11A/U	75	20.5	5000
14A/U	52	29.5	7000
17A	52	29.5	11000
22/U	95	------	------
54A/U	58	-----	-----
55B/U	53.5	28.5	1900
58/U	53.5	28.5	1900
58A/U	50	29.5	1900
58C/U	50	29.5	1900
59/U	73	21.0	2300
59A/U	75	20.5	2300
59B/U	75	20.5	2300
62/U	93	13.5	750
62A/U	93	13.5	750
63B/U	125	10.0	1000
71/U	95	13.5	750
71A/U	95	13.5	750
71B/U	125	13.5	-----
79B/U	125	10.0	1000
108A	78	20.0	1000
141/U	50	29.0	1900
174/U	50	30.0	1500
178/U	50	29.0	1000
179B/U	75	19.9	1200
187/U	75	19.3	1200
187A/U	75	19.5	1200
188/U	50	29.0	1200
188A/U	50	29.0	1200
195/U	95	15.2	1500
196A/U	50	29.0	1000
212/U	50	29.5	3000
213/U	50	30.5	3000
214/U	50	30.5	3000
215/U	50	30.5	3000
217/U	50	29.5	7000
223/U	50	30.0	1900

Fig. 5. These figures may vary slightly from manufacturer to manufacturer.

With this type of transmission line, radiation is eliminated and isolation figures approaching 100 dB may be achieved. The shield also serves as a protective jacket, and as such, weight is reduced 1/2 pound per 100 feet over conventional cable.

Most flexible coaxial cables use vinyl as the jacket material. As polyvinylchloride is brittle, plasticizers are added to make a more flexible material. Under exposure to heat and sunlight, these plasticizers tend to leach out, or migrate through the braid and into the polyethylene dielectric. This migration results in an increase in dielectric constant with an abrupt increase in attenuation, and with the leaving of the plasticizers, the vinyl becomes brittle and cracked. This allows moisture to enter the cable and causes the dielectric constant to deteriorate even more. At this point, which may take anywhere from five to ten years, the cable must be replaced. Much of the cable now available uses resinous plasticizers that will not migrate, resulting in a cable having a lifetime well in excess of 10 years.

Another type of jacket material called Xelon does not contain plasticizers at all, so life expectancies of over 25 years may be realized. Xelon jackets also allow direct burial and submersion in water for those really exotic antenna systems.

Solid dielectric coax is available in impedances ranging from 50 to 75 Ohms. Other impedances are available, but they do not match the feedpoint resistance of the antenna systems that are in common use by hams, so they are to be avoided in most cases. Unfortunately, it is this "mongrel" cable that's often sold "cheap" by surplus houses.

Parallel Conductor Lines

There are two major types of parallel conductor lines: Open-wire line shown in Fig. 4, at C, and twin-lead shown at D. Open-wire line is constructed of either #12 or #14 copper (or copperweld), separated at intervals by spacers. In commercially made lines, these spacers range from 1 to 6 inches long and are made of ceramic, porcelain, or steatite. The shorter spacers are used at high frequencies to prevent incomplete cancellation. The characteristic impedance of most

open-wire line is on the order of 400-600 Ohms, depending upon wire size and spacing.

Although the absence of a lossy dielectric, except at the insulators, allows this line to have lower attenuation than coax, there is a fly in the ointment. The problem stems from the fact that open-wire line must be balanced. In other words, the current in one conductor must be exactly out of phase with, but the same amplitude as, its neighbor in the other conductor, if full cancellation is to take place. These conditions are not as important in the "unbalanced" coaxial cable where one conductor is completely surrounded by the other. Because of this, open-wire line must be kept away from metal objects that might couple to one conductor more than the other, causing imbalance. For this reason, open-wire line should run for a quarter wavelength at right angles to the antenna it is feeding. Don't let this influence your choice of a type of feeder. Open-wire line can be operated at much higher standing wave ratios than coax, an advantage that may prove to out-weigh quite a number of disadvantages.

Several types of television type lines are made that can be used in ham applications. The first is called "ladder line," and is a close-spaced (1/2 to 1 inch) version of open-wire line. The second type is twin-lead. Twin-lead is more lossy than ladder line, but it still has a considerable edge over coax. It is also very flexible, being only a thin, small ribbon, and is inexpensive due to its simplicity.

Characteristic Impedance

At this point, on the chance you may have occasion to use it, a quick mention should be made of how to calculate the characteristic impedance of various types of transmission line.

The impedance of air dielectric coax is given by the equation $Z_o = 138 \log_{10} (D/d)$, D= inner diameter of shield, and d= wire diameter. The impedance of solid dielectric coax is given by the equation:

$$Z_o = (138/\sqrt{K}) \log_{10} (D/d),$$

where both D and d are the same as above, and K = the dielectric constant of the material between conductors. Finally, the characteristic impedance of air-insulated parallel conductor line is given by the formula $Z_o = 276 \log_{10} (b/a)$, where b = the center-to-center distance between conductors, and a = the conductor radius. In all of the above, the measurements may be in any convenient unit, so long as all measurements are in the same unit, with the exception of K, of course.

Choosing A Transmission Line

Important factors involved in choosing a transmission line include antenna impedance, operating frequency, feedline length and where the cable will be used.

Fig. 5 gives the pertinent characteristics of about 40 types of cable found on the new and surplus market. Although this table doesn't cover the entire RG series, it should prove helpful in finding out the impedance of military and other surplus cables. If low cost is important, surplus should be strongly considered, though it would be good to keep in mind that military surplus may have been stored for a long time. In this respect, surplus cable might be a bit less flexible than new cable, but all-in-all surplus is in good shape.

When choosing your transmission line, the first consideration is the feedpoint impedance of your antenna. Today, commercial antennas have been standardized to either 50 or 75 Ohms. For 50 Ohms RG–8/U (or RG–8A/U) is used for high power (over 400 Watts) purposes. For low power applications, particularly below 30 MHz, either RG–58/U or RG–58A/U are used. The 75 Ohm counterpart of RG–8/U is RG–11/U and the counterpart of RG–58U is RG–59/U.

As a point of reference as to what transmission line to use, dipoles have impedances ranging from 60 to 70 Ohms, so either of the above mentioned cables may be used. Verticals have impedance values of 30 Ohms, making 50 Ohm cable suitable. Folded dipoles are 300 Ohm, making TV ladder line and twin-lead a good choice. For the most part, all antennas will have some type of corresponding cable that will serve your purposes.

Above 100 MHz, either low-loss coax or

open-wire line should be used, especially if you're operating low power. Both RG–8/U and RG–11/U are acceptable, but when even lower losses are desired, coax with foamed polyethylene and seamless aluminum jacket should be put into service. Below 30 MHz, unless the feedline will be hundreds of feet long, any type of cable is adequate, including open-wire line. Long runs of coax, covering more than 200 feet, can be detrimental even at 3.5 MHz, meaning that more efficient types of coax will be necessary. Other than that, the five coaxial cables and two parallel conductor feedlines shown in Fig. 1 should hold you in good stead.

The final consideration in your choice of transmission line, and one that is not worried about very much, is jacket material. As we mentioned back under "Coaxial Cable," the average coax is good for around 10 years, at best, when used under bright sunlight or warm temperatures. If 10 years sounds long enough, then regular coax is for you, but for lifetimes approaching 15 years, coax intended for outside *rigorous* conditions should be purchased. This coax has resinous plasticizers mixed with the vinyl and is often called semi-contaminating, which may help you to identify this cable from the short descriptions given in most catalogs. If you really want to get your money's worth, coax with a Xelon jacket will provide over 25 years of service, even under conditions that would hasten the deterioration of ordinary cable. Xelon is also your best bet for long-term burial or submersion in water.

Conclusion

Now that you probably know more than you ever wanted to about transmission lines, believe it or not, there's plenty more. But even though many facets have not been covered in this article, it is hoped that enough has been presented to allow you to choose the proper line for your installation. In any case, a knowledge of transmission lines is valuable for the FCC exams and will put you in a position where you can understand and use them whenever necessary.

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Caught "Spying" by the Gestapo

A rising banshee wail of air raid sirens suddenly drowned out the drone of voices and music in one of Munich's most famous sidewalk cafés. From around the corner came a series of Nazi squad cars filled with brown-shirted troops, led by a big, open-topped Mercedes, all screaming their tires as they headed for the Ludwigstrasse. Almost immediately the roar of low-flying aircraft descended upon us. Looking up in startled amazement, one could see bombs in great clusters coming down from the misty, overcast sky.

In a matter of seconds, the peaceful normalcy of the place was turned into chaos. Waiters dropped their trays. Amidst crashing glasses and crockery, tables and chairs were upset as people scampered for safety.

My friend Hans von Liliencron D4VAG smiled and lifted his beer glass. "Take it easy. This is a fake." As he spoke, a number of bombs came plummetting into the Maximiliansplatz, bouncing as they hit. "That Hitler fellow is a tough customer," he said. "I learned only yesterday that on his orders Goebels and Der Dicke cooked up this deal to frighten the German people into accepting his plans for rearmament. The planes are anything they could scrounge up from local airports — and this same stunt, or air raid, is being staged simultaneously in a good many of our cities."

"Who is Der Dicke?" I asked.

"Hermann Goering, of course, the fat one, who is in charge of building up the German air force again. Go out and grab one of those bombs. It'll make a good souvenir to take back to the States. They are harmless — papier-mâché, with a slight weight in the nose, so they'll come down realistically. They'd hardly knock your hat off if one happened to hit you. But hurry. We must be off."

He didn't need to tell me twice. I managed to retrieve the last fake bomb available. Other people with the same idea had rushed out and scooped up the rest of them. The bombs were remarkably real, light as a feather — but slightly weighted in the nose end and deadly looking, painted a glistening grey-black. Mine had France's tricolor stenciled with significant phony letters and numerals on its side, obviously to scare the German population into fits as to what could happen.

It seemed to me that after the first shock, people were more amused than scared. Nevertheless, it was a psychological triumph for the Nazis — because the dread of what could happen remained after the laughs.

My friend Hans von Liliencron's ham station D4VAG in Sölln, a suburb of Munich, was a renowned DX signal on 20 meters back in the early thirties. Frequent QSOs with him on CW and voice from my

old W2AMD at Catskill, New York, had now led to my meeting him personally, shortly after enrolling at the University of Munich in 1933. His family's manufacturing firm was one of the great machine tool outfits in Germany, of which he was president.

On this late November afternoon he'd told me to meet him at the Café Luitpold for a beer. We'd then head out to his villa in Sölln for cocktails, dinner and some DX contacts back to the USA. I hoped to get through to my brother, Dick, who was operating my station at Catskill, to tell him I'd be sailing for home from Cherbourg on the Cunarder Mauritania at the end of the week.

"I'll take the bomb," Hans said. "You'd have trouble handling that thing on the motorbike. We're going to be much interested this evening in hearing about your meeting with Der Fuehrer today. I've asked a few friends in."

His red and black LaSalle convertible pulled out from the curb, as I kicked the motorcycle into action and fell in behind him. A few moments later, though, I lost out as a traffic cop raised his white-gloved hand. By the time I could get going again, Hans was out of sight.

With fall mists from the Isar River rising up at about dusk, it is easy to get lost in Munich. I sure did. Besides, thoughts of the morning meeting with Adolf Hitler tended to jumble my attention. Once more the white-gloved hand of the law brought me to a halt. This time I'd gone merrily the wrong way through a one way street, with no attention to traffic signs or speed limit. It's doubtful that my two glasses of beer were not in some way involved. Fortunately, the law failed to consider this possibility.

He just ticked me off in no uncertain terms. When he'd finished getting all the data his arresting formula demanded, including the names of my parents and grandparents with their nationality, dates of birth, education and professions, plus my own, and, most particularly, the name of someone who could vouch for me – he let me proceed, after handing me my ticket. The Germans are very thorough. Of course, I named Hans as my local sponsor, it being his motorcyle.

Shortly later, I managed to find the house on the Albrecht Dürerstrasse in Sölln and chugged in to park amidst a dozen or so fancy cars. Obviously, a party was in progress, the white stucco villa gay with lights, voices and music.

The Johnson Q 20 meter antenna looked just great, hung between a chimney pot and a 70-foot pole on the back lawn. Recently, conditions had been excellent by mid-evening for QSOs with the States.

They must have been watching for me. Hans appeared immediately behind the old family butler, coming to the door with Frau von Liliencron, a famous Bavarian beauty. Except for my skiing friend, young Baron Ubi von Talphal, most of the faces were new to me. Hans raised his hand and shook a finger in the direction of the small Bavarian band that was playing on the glassed-in terrace. Their music faded to silence, as he introduced me to his friends. The hush was a bit disconcerting. We walked toward the dining room punch bowl. "I've told our guests you'd give us some details about your meeting this morning. OK?" He handed me a silver cup of the punch, which was a powerful mixture of cognac and cherry brandy, somewhat diluted with soda and fruit juices. Strawberries floating around in it gave the stuff an innocent appearance. It was strong enough to loosen the tongue on a plastic ski boot.

"Sure," I replied, "but there's not much to tell."

He put his hand on my shoulder. "Please, let's have it in English. Your German is pretty OK – but so is our English."

The punch was warming. All eyes were on me and the hush was vibrant. There was something odd about their eyes, though, particularly the women's. One of them, in a sort of reflex action accompanied by an embarrassed grin, had even reached out with a hesitant hand and touched my arm. It was as if I were the little man from outer space. Then it dawned on me – I had met their God. I'd better be careful what I said.

"It all happened rather fast," I began, "so there's not much to describe. A committee at the University selected three of us from the hundred or so foreign students to meet

"Looked like a party'd been going on! Der Fuehrer was Heil Hitlering himself in front of the big new mirror. I got the door closed without his noticing me. He'd have had me shot before breakfast." From the memoires of Heinz Sputzlein, Hitler's personal servant during early days of The Third Reich.

the Chancellor. With me was a Norwegian girl and a South African language student.

"At 10:00 am we met at the partially completed Bavarian headquarters of the Nazi Party. At least we were told that's what the building would be. When I got there the other two students were already talking to a Reichswehr Colonel, the Fuehrer's Aide, who had interviewed us at the University. The place was practically buzzing with activity, storm troopers hurrying this way and that. Immediately inside was a large entrance hall, with a high ceiling and many supporting columns running its length. Some construction platforms and other gear indicated the building was either being repaired or was incomplete. But you must know these details."

"Not at all," said Hans. "None of us has ever been in the place. Do go on."

"Well, we were ushered by the Colonel through an extremely narrow corridor in single file, and out into a rather huge room, which was the Chancellor's office, or reception room.

"Almost a silhouette because of the big windows behind him, Mr. Hitler was studying some papers and did not look up at first. Several troopers were standing at ease along the walls, each of them watching us carefully.

"Then Mr. Hitler, I mean Der Fuehrer, got up and came around the edge of his desk. Our escort, the Colonel, then introduced us one by one, my turn being the last, as we shook his rather limp, dry hand. It was an exciting moment for us, so it's hard to remember the details."

Ubi von Talphal cut in, "What did he say to you? We'd certainly like to know that."

"Sorry. Of course. The only word I understood was 'Gruesse'. The rest of it was so fast and in his Austrian dialect that it didn't register. However, the Aide translated for us: 'The Fuehrer greets you with warm welcome and suggests that when you go home you tell your countrymen of the wonderful progress we are making – in contrast to what your rotten newspapers say about us.' "

About then the guests all started talking at once. Hans raised his hand again to quiet things. "There must be something further you can recall? Herr Hitler's remark about the newspapers, even our own, has much truth to it, as we all know. Perhaps there was something else of significance?"

I thought for a moment. "Yes, indeed there was. His eyes. Although looking at us – his focus seemed to be way beyond, perhaps on the people who would hear of this meeting."

That seemed to please them. Hans gave the signal for the orchestra to start again, and we headed for the punch bowl. What I hadn't said, out of courtesy to my host – and it certainly would have gone over like a fox in the chicken house – was that their beloved Fuehrer smelled, smelled to high heaven. The musty, sour smell of dried perspiration surrounded him like a cloud. Reflecting his peasant background where bathrooms were few and far between, if available at all, he probably was unaware that he smelled like a pigsty and assumed that everyone else did, too. At the time, a good many of us didn't realize that his politics had a similar aroma.

One other thing I noted but did not mention: The long, narrow passageway we passed through on the way to Der Fuehrer's reception room undoubtedly was an electronic screener, an x-ray deal to detect any dangerous looking objects on visitors. These gadgets were quite new, but I'd already seen one in the Deutsches Museum in Munich.

Like everything in Hans's establishment, the buffet dinner was delightful. Shortly thereafter the rest of the guests departed and we repaired to the radio room. Twenty meters was really hot, with stations from all over Europe and Scandinavia booming in. Hans allowed that we were in luck. "Within half an hour or so the USA will be coming through. You'll find out what your own station sounds like 3,900 miles away. How about that?"

The crystal controlled phone/CW transmitter had a pair of 852s in the final, with about 400 Watts input, most of the parts imported from the States. He had several receivers: a National HRO, a British Edisto and several German jobs. The place was a ham's paradise.

In short order, we'd worked a dozen or more countries, including Morocco and the

Azores. At the scheduled time, sure enough, there was W2AMD calling us with a good strong CW signal. I passed the word along to brother Dick about my reservation on the Mauritania, which would be sailing for New York two days later.

We were in the midst of the QSO when the butler came in with word of an urgent telephone call for Hans. There'd been an automobile smash-up involving a close friend down near Starnberg, some 20 miles to the southwest. "Not too bad," Hans said a few minutes later, "but I probably won't be back until the wee small hours. Carry on and have fun with the rig. I'm sure you can find your way back to Munich under the full moon."

He should have shooed me out of the place at that point. Definitely.

A series of swell QSOs followed, several out to the West Coast of the USA, some South Americans – and then the band closed off in that direction. Suddenly I heard some Russian stations, either just tuning up or calling CQ. Oh boy, I'd never worked a Russian up to that point.

RA-2ZL, giving his location as Moscow, exchanged reports with a guy in Stockholm. Then he called CQ and came right back to my answer. We not only exchanged reports and locations but I gave him my name, local and home address. I wanted to get at least one Russian QSL card. I did the same thing with several other Russians before closing down about midnight and heading back to town.

Early the next morning my landlady banged on my bedroom door. Her face was white as a sheet. "There are two men here from the Secret Police to see you – the Gestapo," she managed to say, a trembling hand over her mouth. I was dressed and ready to head for the University. Must be something to do with my motorcycle arrest, I thought.

My callers were in the new black uniform of the Schutzstaffel, or personal bodyguard of the Fuehrer, which had been adopted by Himmler's goons. They were solemn, tough looking troopers. Raising the Hitler flapping-arm salute, the senior of the two requested my identification card, which I gave him. "Please, you will come with us," he said. His German was a lot more understandable than the noises his big boss had made the day before.

There was no question about compliance. I would obey – or else they'd take me with them anyhow. Machine pistols in dull black holsters were very much in evidence on their belts. The car was a trim looking black BMW, ornamented with the Nazi swastika and a black and white Maltese cross. A sinister chariot.

As we got in, I asked, "What's this all about? Would you gentlemen please tell me why going through a one way street incorrectly warrants all this attention?"

A faint smile from the hulking older Nazi, our driver, indicated that my reference to "gentlemen" had touched him. He'd probably never been referred to that way before. But he remained silent as we roared down the Ludwigstrasse.

At Gestapo Headquarters in a ratty looking building near the Rathaus (town hall), my escorts hustled me into the presence of their officer-in-charge, a sleazy looking, black-uniformed character with very bright eyes and dirty fingernails. After a few moments of hushed conversation with them, he turned his attention to me. "You don't think much of our laws here in Germany, do you?" Before I could come up with an answer to that one, he lifted some papers from his desk and continued, "What's this about your ignoring a one way street? Perhaps we should change all the rules to suit your fancy?"

My big mouth. "Well," I offered, "I just wasn't paying attention, didn't notice the sign. I apologized for the error to your police officer who told me there'd be a small fine."

"That is correct," he snapped. "But that is not why you are here. Do you realize there are serious penalties for spying?" He raised his eyebrows and stared at me coldly.

"Spying?" I could hardly believe my ears. A thin, icy chill raced up and down my spine. This guy was not fooling. Thoughts of dungeons and firing squads flashed to mind. I was alone, a foreigner.

"Yes, spying," he said. "The Third Reich is going to deal harshly with anyone who gets in our way. Now tell me, just what

transpired last night in your talks over the wireless with those Russian communists?"

So that was it! I suddenly remembered I'd heard something about Nazi decrees as to what countries were taboo, but it hadn't made much impression. Hans had not mentioned it, probably assuming I knew the regulations. In any event, I must make sure he didn't get in trouble.

The Nazi seemed to read my mind. "Your friend Herr von Liliencron is an important Bavarian, but we take no chances. He was in Starnberg last night checking on an automobile accident while you were operating his wireless. He is not involved in this in any way, except allowing you to use his equipment unsupervised. Please answer my question. What did you tell those miserable communists?"

"Nothing," I said. "We merely exchanged reports as to how loud our respective signals were, and I gave my name and home address to several Russian stations."

"We know all that. You also sent a lot of signals that began with the letter 'Q'. In these we are interested. Do you deny this is a code, an international code?"

"Of course it's a code, a means of exchanging information from one language to another in short order."

"Precisely what we wanted to know!" His eyes narrowed and he pointed an accusing finger at me. "So you were giving the communists quick information in a code?"

"That is true – but not in the way you infer. Perfectly innocent stuff. I don't speak any Russian and those guys didn't speak any English."

"That remains to be seen. We are going to put you under house arrest until this entire matter is investigated. It's almost certain you amateur radio nuts are going to be closed down before long. You mess up our programs on the Deutscherundfunk and we've decided to really fix you."

Apparently the monitoring outfit hadn't tuned in on us when I was talking to W2AMD. Otherwise these birds would know I was about to beat it out of their Third Reich. The guy was a fanatic, a BCL, who was out to get my scalp. And at the moment there was nothing to be said in their book in my defense. Just then, with no warning, the door onto the Marianplatz burst open and in strode the Reichswehr Colonel, Aide to Der Fuehrer, followed by Der Fuehrer himself. They whirled by our little group, our BCL Gestapo official and his pals at stiff attention with their right arms up in rigid obeisance to the Chief. "Heil Hitler!" they shouted.

Fortunately, the Fuehrer's Aide, before disappearing with his boss down the corridor, did a double take when he saw me. More loud "Heil Hitler's" in the background indicated that some kind of big time conference of the brass was about to commence.

My inquisitor was squaring away for more nasty questions as he shuffled papers that obviously were the monitoring notes on my radio transmissions.

Suddenly the Colonel came pounding back down the corridor. He greeted me with a curt nod and touched the visor of his cap. "What the devil is going on here?" he demanded of the Gestapo officer.

Hurriedly the latter explained deferentially, almost humbly, the nature of my evil activities. It seemed that he had no desire to tangle with a high official on Hitler's staff. The Colonel listened carefully but impatiently and thumbed over the monitoring notes. "Does Herr von Liliencron know about this?" he rasped.

"Oh no, Sir, we had the telephone to this man's pension (boardinghouse) blocked so that no one could communicate with him before we got out there for the arrest."

The Colonel looked as though he were about to explode. Even then there was no love lost between the Reichswehr, the Brownshirts and the Gestapo. "This is the most colossal piece of damn nonsense I've ever heard! This young man has been thoroughly investigated and only yesterday had the extreme honor of being presented to the Fuehrer at the Brauneshaus. I sponsored him."

The Gestapo boys were beginning to look sick, their eyes unblinking, their mouths open. "And further," the Colonel continued, "I shall personally apologize to Herr von Liliencron for your intrusion into his private affairs. You will of course release this young man at once and not annoy him any more. Do you understand?"

"But yes, Herr Colonel." The Gestapo officer looked ashen.

The Colonel turned to rejoin his meeting. "One other thing. My son is studying to be an amateur radio operator himself. He says there are altogether too many artificial regulations already. The ban regarding communication with the Soviets is ridiculous, so far as radio amateurs are concerned. Action is being taken to have it rescinded. There may come a time when we need these young men in the armed services. The more training and experience they get now, the better." He looked at me. "Please accept our apologies. I shall have a staff car return you to your pension. Heil Hitler!"

"Thank you, Sir," I stammered.

For an instant he glared at the Gestapo threesome, and then made off down the hall to his meeting.

Later, over another beer at the Luitpold, I gave Hans the gory details, offering profound regrets for my bad judgment in talking to the Russians.

"Forget it," he said. "It was a natural error, partly my fault for not telling you of the ban. The Colonel handled those black-shirted roughnecks very well. However, we have to be careful these days. I think it is most fortunate you are leaving the country tomorrow, while those fellows are still shaking from the dressing down they took in front of you. You can be sure they won't forget this – and probably would make you some serious trouble if you stayed on."

He wouldn't take the 20 Reichsmarks I'd found out would be the fine for my motorcycle caper. I never saw him again, although we had a few QSOs on my return to the States before all German hams were closed down prior to World War II.

On leaving Munich the next day, I didn't draw an easy breath until my train had rumbled across the Rhine and entered France from Kehl to Strasbourg.

Long years later, I learned that the Reichswehr Colonel, by that time a General, was part of the conspiracy and one of those who lost his life as a result of the attempted assassination of the Fuehrer on July 20, 1944.

. . . W1BNN

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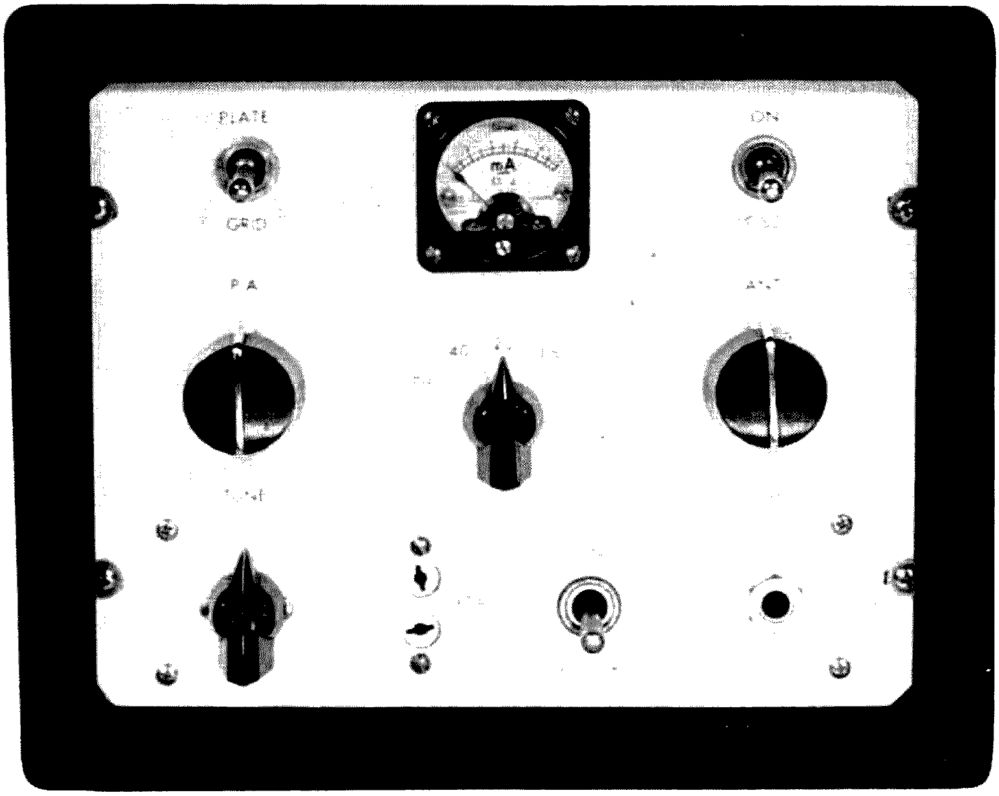


Why Tubes Haven't Died

I am told that some veteran hams are not building anymore, and that some newcomers to the radio hobby haven't yet tried to build a piece of equipment for their shack. I am told that this is happening because of a preponderance of transistor and IC projects appearing in the magazines, while the average ham's junk box remains best suited for constructing vacuum tube projects.

How often have you become frustrated trying to find some prototype IC that a parts list requires, or a 2N - - - transistor for which there is no SK, GE, ECG or HEP equivalent, or just discouraged by the number of special devices you would have to buy? Well, here is an excellent opportunity to use some of those toggle switches, tube sockets, transformers and variable capacitors you have stored away in that junk box. Your reward will be a nice little 5 band CW transmitter: QRP, but not too QRP. It will run off that old H.V. supply you probably have around the shack, or a dynamotor and 12 V source for field day or mobile CW work (have you tried mobile CW?). The project uses only two tubes, no semiconductors (unless you count resistors), and all standard junk box type parts. There is simply no excuse for not building this portable CW transmitter.

The unit is small, compact but not crowded. It was designed to fit into a surplus cabinet that I had on hand, with compartments on each side for storing the power cable and CW key. The front panel is 19.3 cm wide, 15.1 cm tall, and the chassis extends to a depth of 14 cm. The actual layout you use will depend upon the box you intend to put it in.

Continued on page 128

The tube complement is a pair that should be familiar to most readers: a 5763 operating as straight-through or multiplying oscillator, and a 2E26 power amplifier running about 20 Watts input. The filaments are tied in series with an equalizing resistor across the 5763 for 12 volt use. You can wire them in parallel and omit the resistor if you intend only to run off a 6.3 V ac supply. The "OSC" switch opens the B+ line to the 5763 to silence the oscillator while receiving; it otherwise runs continuously to provide a chirp-free signal.

A meter (0-1 mA) on the front panel provides the necessary indication for tuning up and input power monitoring. "GRID" position on the meter switch allows you to peak the grid drive to the final, and "PLATE" lets you dip the plate current. An antenna loading control is also provided to the right of the band switch. The key jack is a closed circuit type.

Since there are no multiplier stages, it would appear that crystals cut for the particular band of intended operation would be required. It was found; however, that the harmonics of 80 meter crystals were usable on 40 and 20, and 40 meter rocks provided usable output on 20, 15 and 10 meters. Select crystal frequencies that will allow you to work in several bands.

The band switch is a 2 section rotary with special shielding to separate the output of the P.A. from its input. You will notice that most oscillator components are on the underside of the chassis, while the output circuit is all above the chassis. This, and the bypass capacitors (.001) used on all dc lines, prevents self-oscillation of the final tube. The shield around the rear section of the band switch was folded up from a 6.4 cm wide strip of aluminum and drilled to pass the switch shaft and standoffs. The shield itself is bolted to the chassis over a slot, through which connection is made to the oscillator coil (L1) taps. Connections to the amplifier tank coil (L2) taps come over the top of the shield from the forward switch section.

The coil L1 is 46 turns of B&W no. 3016 or Airdux 832: 26 mm diameter, 36 mm long. It is tapped at 3-1/4, 6-1/4, 8-1/4 and

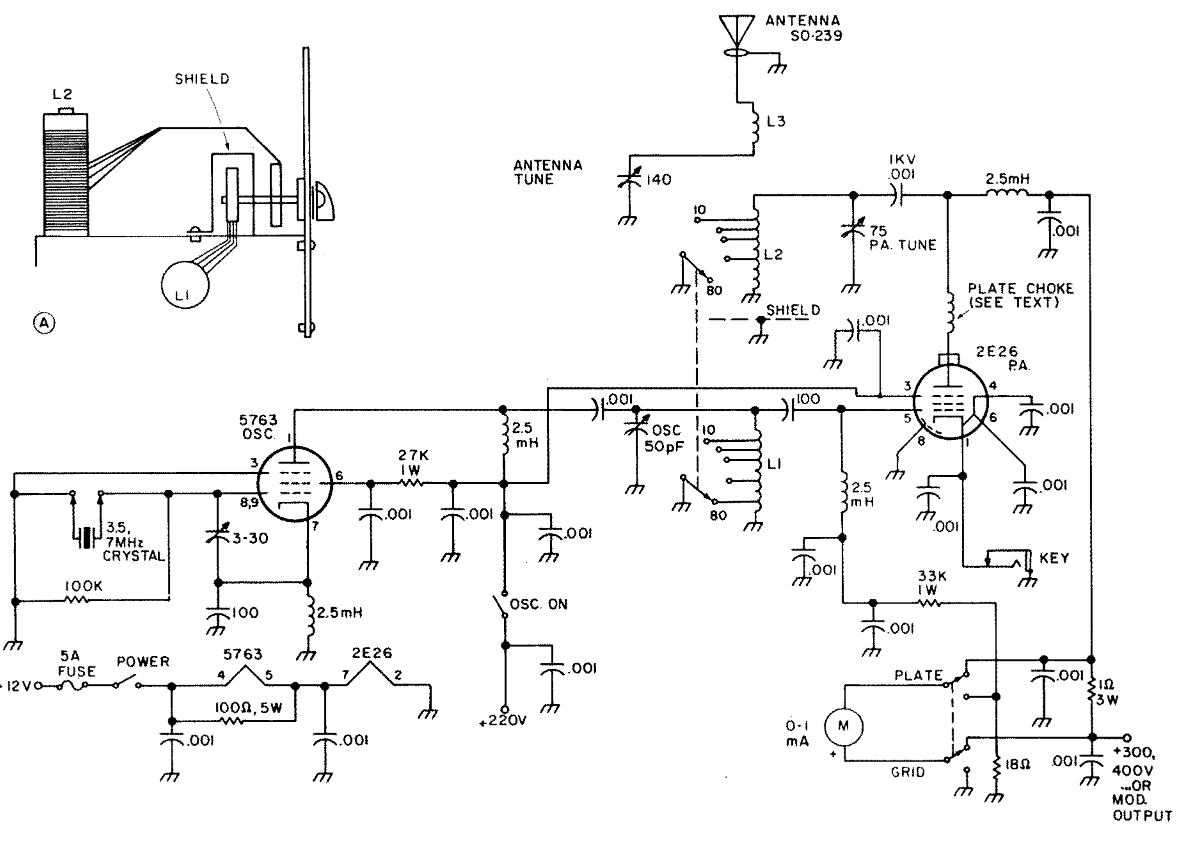
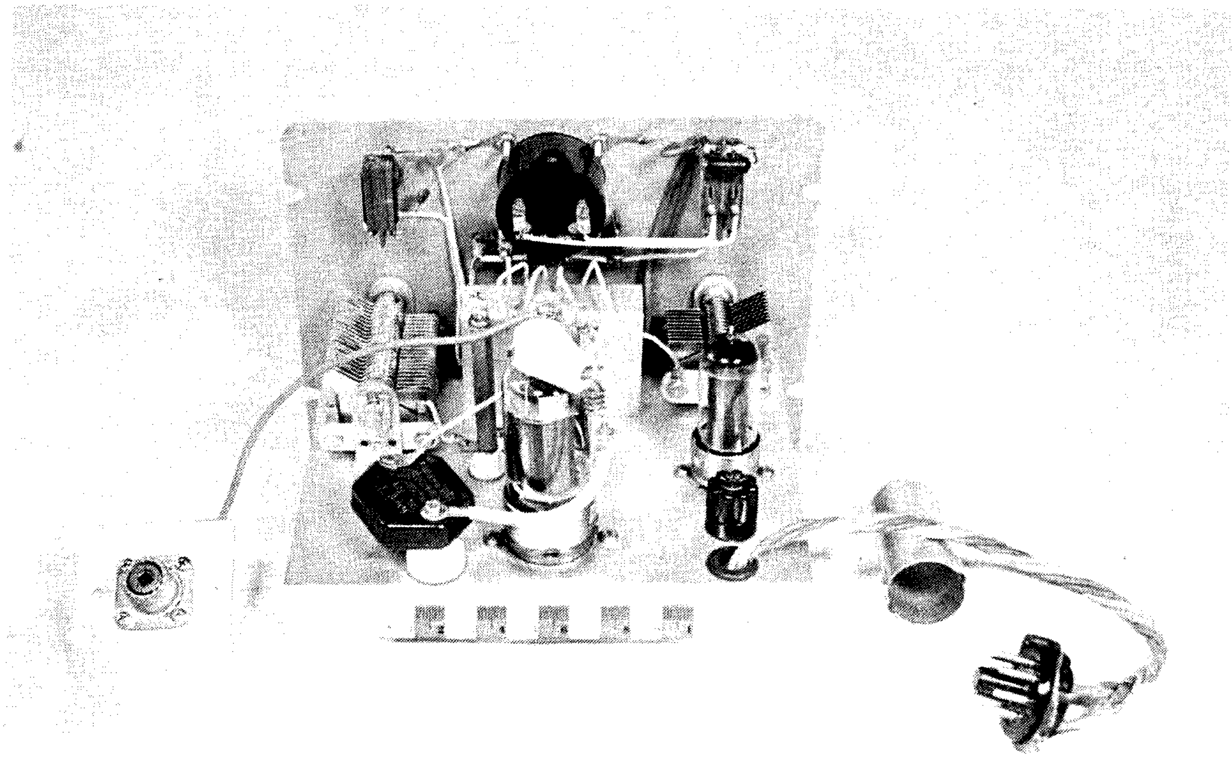


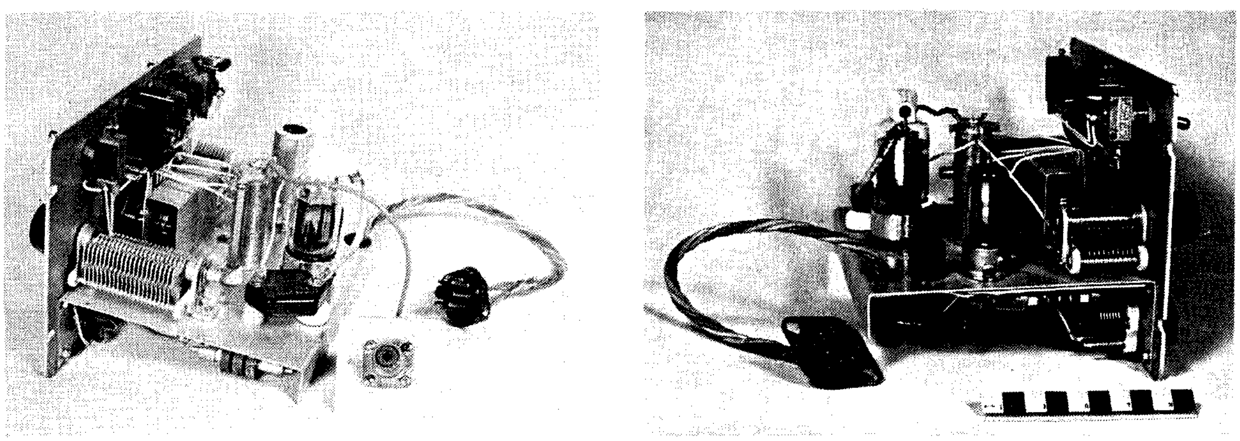
Fig. 1. Schematic. (A) Side view showing position of coils, band switch, and shield.



Rear view.

21-1/4 turns from the high end, for 10, 15, 20 and 40 meters. It is easier to solder taps to this type of coil stock if you push in the wire on either side of the turn to be tapped with a pointed tool first. The wires from these taps to the band switch are about 5 cm long.

Coil L2 is the output tank, wound on a piece of wood dowel, 19 mm diameter, with no. 24 tinned wire. 52 turns are wound, evenly spaced, to make a 55 mm long coil on the wood form, which is about 65 mm long. I wound this coil by taking 4 meters of no. 24 wire, tying both ends to a doorknob, and looping the middle of this wire once around a small tack near one end of the dowel. You then wind this double wire tightly up the coil form, in the same direction as the store-bought coils. Wind your 52 turns, keeping the wire tight, while walking toward the doorknob. Secure one of the wires around a tack and unwind the other wire completely. This should leave a single winding on the form evenly spaced. Check that no turns are shorted, and slap on a heavy coat of shellac to finish your coil. Winding

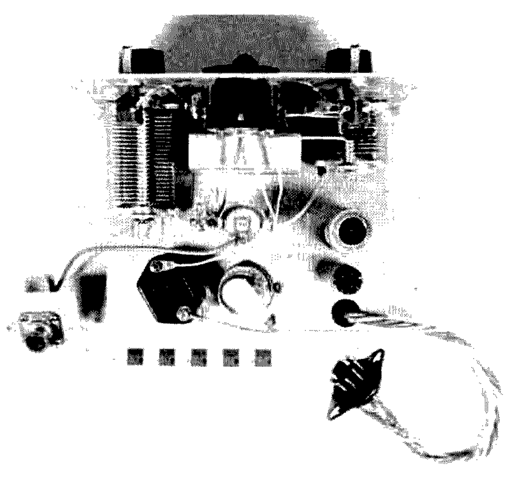


Two side views.

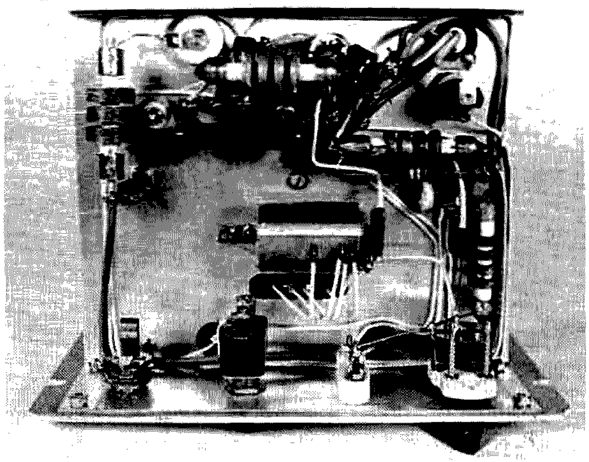
your own coil makes you feel that you've really home brewed the project, like they did in the good (?) old days. You can wind the output link (L3) too, but I had some of the stock coil left over from L1 and used that. L3 is 3 turns no. 24, 26 mm diameter, 2 mm long, mounted just above the high end of L2.

Taps on L2 occur at 4-1/2, 8-1/2, 13 and 24 turns down from the high end. Wires to the band switch average about 7 cm. If you have a grid-dip meter you should check both L1 and L2 for proper placement of these taps after all components are wired together. By coupling your G.D.O. to coil L1 and rotating the 50 pF "OSC TUNE" capacitor, you should find a dip at both the high end and low end of the amateur band for which the band switch is set. The same applies for coil L2 and the associated "P.A. TUNE" capacitor. You may find you have to move the taps a bit to get the best coverage on all bands. If you don't have access to a G.D.O., then just follow my guidelines about taps and wire length as closely as possible.

One additional "coil" you have to wind is the choke at the plate cap of the 2E26. This is just 4 turns, 5 mm diameter, 7 mm long. It can be air-wound with stiff (no. 16) wire or wrapped around any high-value 1/2 Watt resistor. This plate choke is included to suppress any spurious VHF oscillation in the final. The 2E26 is a VHF power amplifier and is somewhat prone to this type of problem. If you ever detect rf output with the "OSC" switch off and the key down, this is spurious oscillation in the final indicating insufficient bypass and shielding between grid circuit and output. If you keep the two always separated by a thickness of aluminum, use bypass capacitors at both ends of all wires going to the meter or panel switches, and use those .001 caps as shown around the base of the 2E26, you should have no problems.



Top view.



Bottom view.

After you finish the construction and wiring, connect filament power and oscillator B+ but not P.A. plate power. Plug in a crystal, set the band switch to the band of the crystal's fundamental frequency and adjust the "OSC" capacitor for maximum grid indication. Adjust the 3-30 pF cap in the oscillator grid circuit for maximum and you are all ready to go. Put the transmitter into its cabinet, connect the final B+, and attach your antenna or matching unit. Touch up the "OSC" setting once again and then switch the meter to "PLATE." With key down, you should get some plate current. Tune the "P.A. TUNE" for a definite dip in the plate indication. Adjust the "ANT. TUNE" for best output as indicated by a field-strength meter, swr bridge, or whatever you use. Now go back and dip the plate again, since the two large capacitors interact quite a bit.

If all goes well and no smoke arises, you will be proud to own and operate this nice little transmitter you built yourself. Once you have finished, you can get started on that IC keyer project (Man does Not Live by Tubes Alone). Enjoy your CW operation.

. . . WA5RON

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Instant Circuits

Every once in a while, something small happens that changes the course of events in our lives. For example, the simple "happening" of an apple falling on Sir Isaac Newton's head several centuries ago triggered the discovery of gravitational fields.

Although not quite in the same class, but equally important to anyone working with electronics, a product has been recently developed that is destined to play an important role in future developments. I'm referring to the various solderless, matrix terminal sockets now available for breadboarding electronic projects.

Depending on which manufacturer you talk to, the sockets may be referred to as "Super-Strips," "El Sockets," "QT Sockets," or "Klip-bloks." But regardless of what they are called, they all have one thing in common – convenience. In fact, after being introduced to their simplicity, you tend to ask yourself, "Now why didn't I think of that?"

With these sockets, a new circuit can be thrown together in a matter of minutes, making electronic projects that much more fun. Also, last minute changes may be incorporated into a new circuit merely by rearranging connections. This feature alone will save you much anguish in working with stubborn circuits.

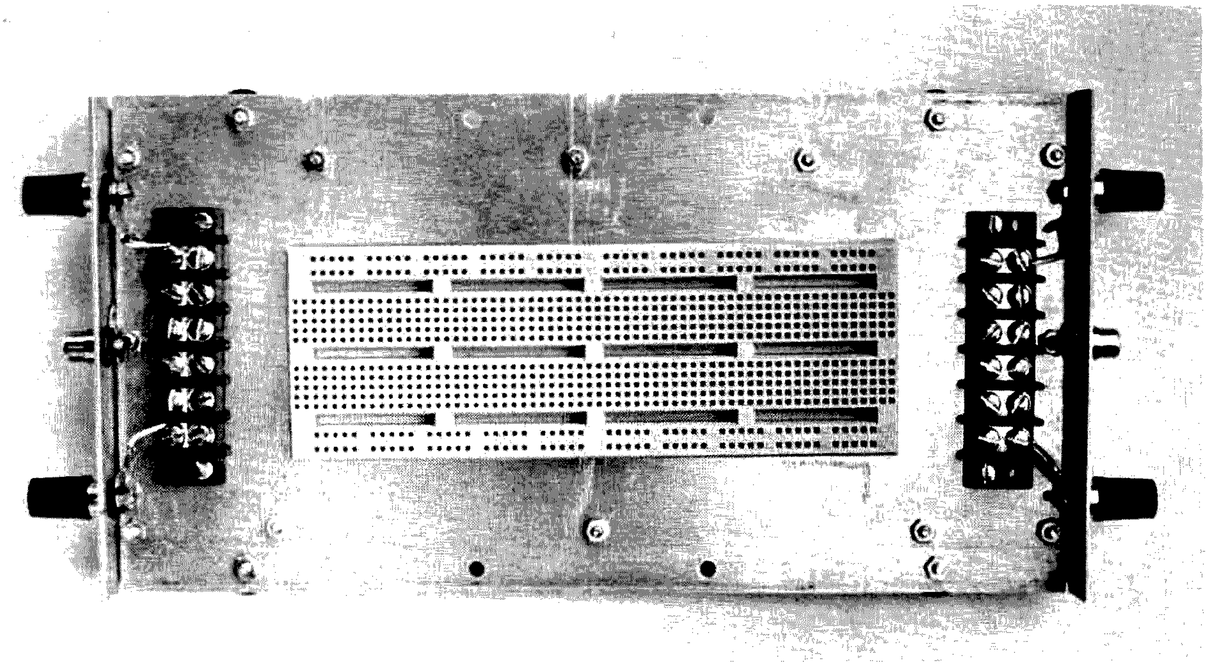
Most of the discussion here will center around AP's "Super-Strip," although each manufacturer has a complete line and assortment of terminal strips for you to choose from. A listing of some of the major manufacturers is contained in Table 1, and I suggest you send for a copy of their brochure before you decide to purchase one.

Background

I was first introduced to breadboarding techniques through an article in *73* several years ago.[1] The solid state breadboard described was constructed and it has been a great aid to me in building electronic projects on short order.

The bus bars were installed in a manner similar to the original design, but I also incorporated additional features such as transistor and IC sockets, internally connected to individual bus circuits. This feature facilitated changing transistors and ICs, and also helped to avoid damaging the semiconductors while soldering other components to the bus.

[1] Goodwin, G. W., "A Solid Solid State Breadboard," *73*, November, 1972, p. 178.



This particular distribution strip consists of 840 plug-in, solderless tie-points, which can accommodate a variety of circuit configurations.

For the past few years, this arrangement has been adequate for my purposes and has been of great assistance. However, there is always room for improvement in everything, and breadboarding techniques are not excluded.

With the advent of new techniques, we now have available universal, solderless terminal blocks for quick circuit building and testing.

These terminal and distribution strips provide you with unlimited freedom in connecting components together to form a circuit. No special tools are required and any solid wire up to #20 AWG may be used for connections.

Terminal strips are also available in many different sizes and configurations to accommodate any circuit layout desired. The terminals accept all component leads between 0.015" and 0.032" in diameter.

As an example, 1/8 Watt resistors have lead diameters of 0.015", 1/4 Watt resistors have lead diameters of 0.025", and 1/2 Watt resistors, 0.032".

"Super-Strip"

My own experience with these products has been with the AP Products' "Super Strip." This particular socket is a combination distribution system with a universal breadboarding matrix consisting of 840 solderless, plug-in tie-points which can accommodate a variety of components and circuit configurations.

The socket measures 2.25" by 6.50" and is currently selling for about $18.00. While this price may seem high at first for an item so small, it is really a super bargain. Once you begin using one and realizing the advantages it has over all other breadboarding systems, I think you will agree that the sockets are worth their weight in gold.

My "Super-Strip" actually paid for itself in one month, considering the time it saved me and the cost savings of reusable components.

Applications

With regard to component locations on the terminal strip, all ICs are mounted in the center as shown in the photographs. In this manner, each IC lead is connected to one terminal of a 5-terminal strip, leaving 4 terminals for other components. The terminals along the edge are connected to form a bus for power supply connections.

I mounted my "Super-Strip" on a 5½" x 10½" aluminum plate with end panels for external connections. Each panel has two 5-way terminal posts along with a phono jack for input and output connections. As an

TRADE NAME	MANUFACTURER	ADDRESS
Super-Strip	AP Products, Inc.	Box 110 Q, Painesville OH 44077
EL Socket	E & L Instruments, Inc.	61 First St., Derby CT 06418
QT Socket	Continental Specialties Corp.	44 Kendall St., New Haven CT 06512
KLIP-BLOK KLIP-STRIP	Vector Electronics Co., Inc.	12460 Gladstone Ave., Sylmar CA 91342

Table 1. Major manufacturers of solderless terminal strips.

interface between these jacks and the "Super-Strip," I use a terminal block to allow changes without soldering.

There is usually enough room on the sides of the aluminum plate to mount large components such as coils, variable capacitors, pots and similar components. I sometimes add a strip of masking tape along each edge of the "Super-Strip" and label component leads to help keep track of connections.

Other arrangements are also possible. For example, the "Super-Strip" can be mounted to a plug-in type printed circuit board. It is then possible to plug this assembly into a master plug board for sophisticated circuits.

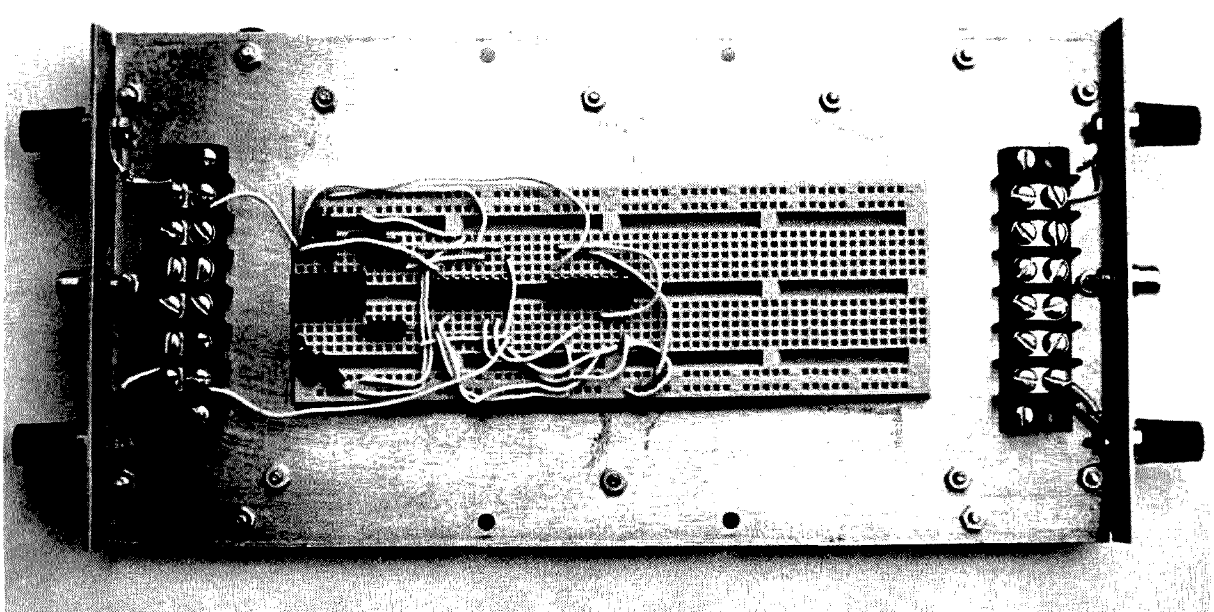
Another application is to mount the "Super-Strip" on a mini-box or chassis, and then put a power supply inside with power brought out through terminals. This provides a completely self-contained unit.

If you really want to get fancy, add a function generator or pulse generator for signal sources – all in one, neat package.

Conclusion

Whether you are a serious experimenter or construct projects on rare occasions, one of the solderless terminal blocks described here can make your project more fun to build. Also, if you are not sure a new circuit will work or needs de-bugging, build it first on a "Super-Strip." Once the circuit is functioning properly, you can build it in more permanent form. This approach can save you both time and money and make life a lot easier.

. . . WB5DEP



Components are generally mounted in the center, leaving at least four tie-points per device lead for interconnection to other components. Input and output terminals are shown on each end of the breadboard.

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K2OAW Synthesizer PROM-oted

A BCD effort.

This article is the end result of finally building a synthesizer for two meters. A few people in town have built the K2OAW synthesizer and a printed circuit board for one was available. I had strong reservations about the switch coding scheme used in the original article since it used several large multi-deck rotary switches and I wanted to use miniature BCD coded thumbwheel switches. The divider coding required on this synthesizer does not lend itself to either BCD coded inputs or direct digital frequency readout. A local ham had a circuit available to do the required code changing, but it required a second circuit board as big as the synthesizer and about fourteen more ICs.

I have some programmable read-only-memories (PROM) on hand and these

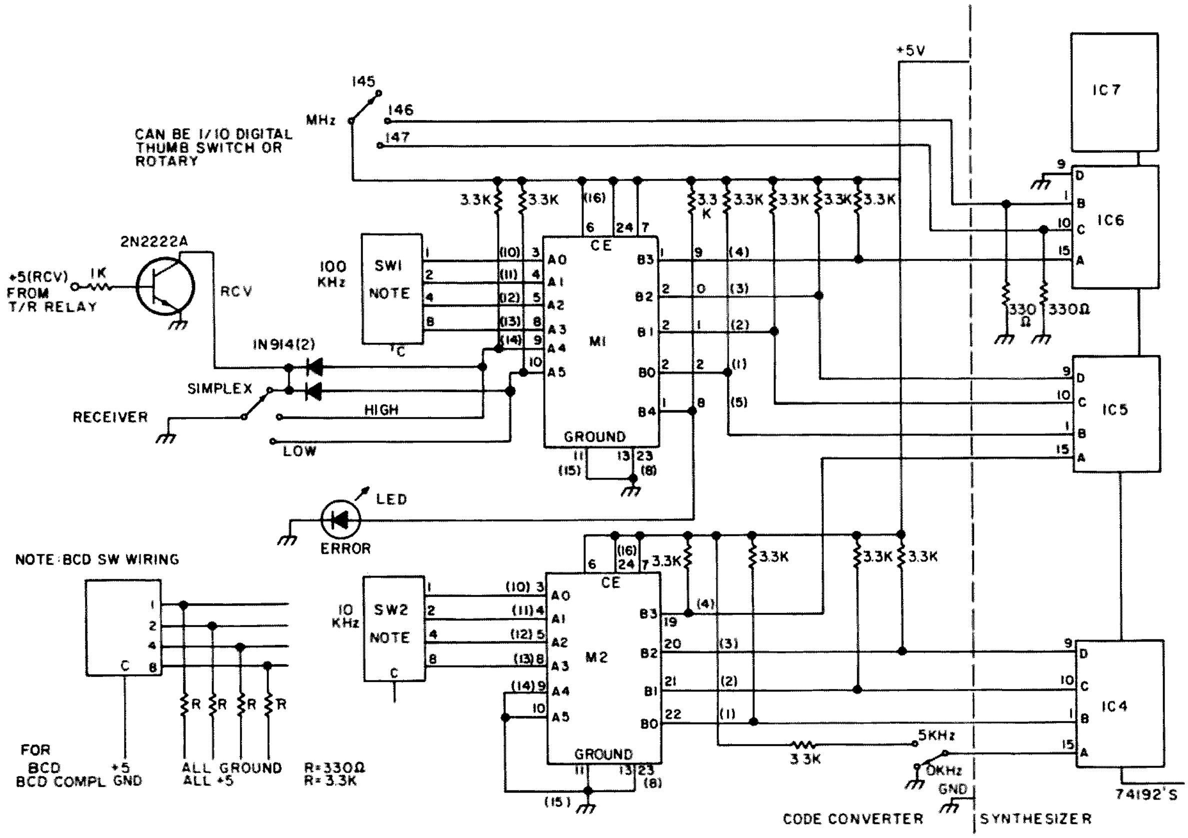

Fig. 1. Schematic diagram for the code converter using a 74186 or Motorola MCM5003. Numbers in parentheses refer to 8223 equivalent pins. The right hand side of the diagram is the interface with K2OAW's synthesizer. M1, M2 – pins for MCM5003 or 74186. All resistors ¼ W 10%.

WORD ADDRESS DEC	OCTAL	DATA OUTPUTS B7	B6	B5	B4	B3	B2	B1	B0	
0 0	0 0									(1)
0 1	0 1								X	(1)
0 2	0 2							X		(1)
0 3	0 3							X	X	(1)
0 4	0 4						X			(1)
0 5	0 5					X				(1)
0 6	0 6					X				(1)
0 7	0 7				X	X		X		(1)
0 8	1 0			X		X		X	X	(1)
0 9	1 1			X	X	X	X			(1)
1 0	1 2									
1 1	1 3	NOTE 3								
1 2	1 4	(8223 ONLY)								
1 3	1 5									
1 4	1 6									
1 5	1 7									
1 6	2 0					X			X	(2)
1 7	2 1					X		X		(2)
1 8	2 2					X		X	X	(2)
1 9	2 3					X				(2)
2 0	2 4				X					(2)
2 1	2 5				X					(2)
2 2	2 6				X					(2)
2 3	2 7				X					(2)
2 4	3 0				X					(2)
2 5	3 1				X					(2)
2 6	3 2									
2 7	3 3									
2 8	3 4									
2 9	3 5									
3 0	3 6									
3 1	3 7									
3 2	4 0				X					(3)
3 3	4 1				X					(3)
3 4	4 2				X					(3)
3 5	4 3				X					(3)
3 6	4 4				X					(3)
3 7	4 5				X					(3)
3 8	4 6									(3)
3 9	4 7								X	(3)
4 0	5 0							X		(3)
4 1	5 1							X	X	(3)
4 2	5 2									
4 3	5 3									
4 4	5 4									
4 5	5 5									
4 6	5 6									
4 7	5 7									
4 8	6 0									
4 9	6 1									
5 0	6 2									
5 1	6 3									
5 2	6 4									
5 3	6 5									
5 4	6 6									
5 5	6 7									
5 6	7 0									
5 7	7 1									
5 8	7 2									
5 9	7 3									
6 0	7 4									
6 1	7 5									
6 2	7 6									
6 3	7 7									

Fig. 2. Programming chart for either 8x32 or 8x64 PROMs. (1) programming same for both M1 and M2. (2) Plus 600 kHz pgm for M2. (3) (74186/5003 only) Minus 600 kHz pgm in address 32 through 41 in 74186 or in address 00 through 09, bits 4 – 7 in an 8223.

devices are ideally suited for code changing applications. The 32 word devices such as the 8223 are becoming readily available at a reasonable price. While I was at the code changing business I discovered I had lots of memory left over, so I decided to do away with the second bank of switches in the K2OAW version and just change receive coding to obtain standard repeater offsets.

My synthesizer now has three thumbwheel switches: One each for MHz, 100 kHz and 10 kHz, followed by a toggle switch for 0/5 kHz. I then have a rotary switch which selects "SIMPLEX," "RCV HIGH" and "RCV LOW." The switch offsets the receive frequency either 600 kHz high or low from the frequency (transmit) set on the switches. Any desired offset can be programmed into the PROMs but 600 kHz is pretty well standardized.

Circuit

The basic circuit and interface with the synthesizer are shown in Fig. 1. The pins are shown for an 8 x 64 word memory such as a 5003 and also shown, in parentheses, are the pins for an 8223.

To change repeater offsets I simply use the dc receive switching signal (+5 for RCV, GND for XMIT) routed through a switch to select which portion of memory is used in the receive mode. If a 32 word memory is used, one of the memory location shifts could be done by externally selecting either the B0 to B3 or B4 to B7 output bit locations with a data selector chip. With my

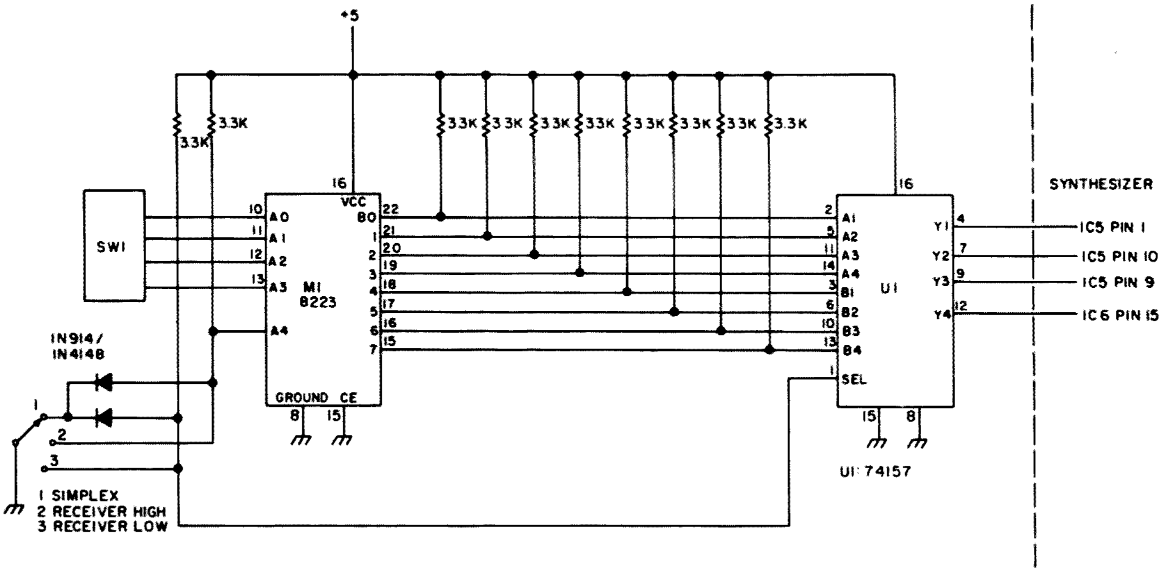

Fig. 3. This circuit will provide similar capacity to Fig. 1 using 8 x 32 word PROMs. All resistors are 4.7k ¼ Watt. M2 wiring is the same as shown in Fig. 1.

64 word memories, the receive code addressing starts at 00, 16 or 32 depending upon switch setting.

One problem could arise with my scheme. If the offset selected (±600 kHz) combined with the dialed frequency falls outside the one MHz band selected, then the receive frequency will be in error, the error depending upon the memory coding (e.g., if 146.40 or above and "RCV HIGH" were selected the frequency would be in the next band segment). I developed a circuit to change the MHz switching automatically, but it added three more ICs to the circuit, which turned out to be more complex than I wanted. Instead I used the B4 output bit in the 100 kHz memory to indicate an error by use of a LED. This output can be used to light a light, ring a bell or whatever turns you on. A note to those of you who already have the K2OAW synthesizer built or planned: The 3.3k resistors on the memory outputs take the place of the 330 Ohm resistors and diodes on the synthesizer board for those lines.

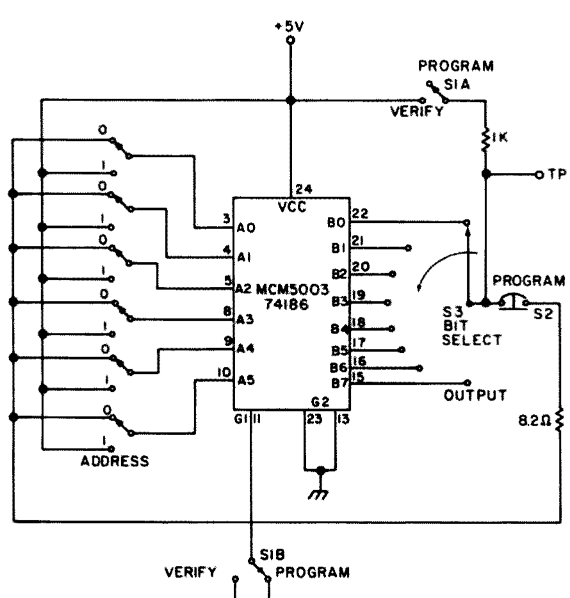

Fig. 4. Simple method of programming the 74186/MCM5003 type device. Operation is explained in the text.

Using PROMs

Contrary to some popular belief, PROMs are NOT particularly difficult to program. Although I have now built myself a fixture

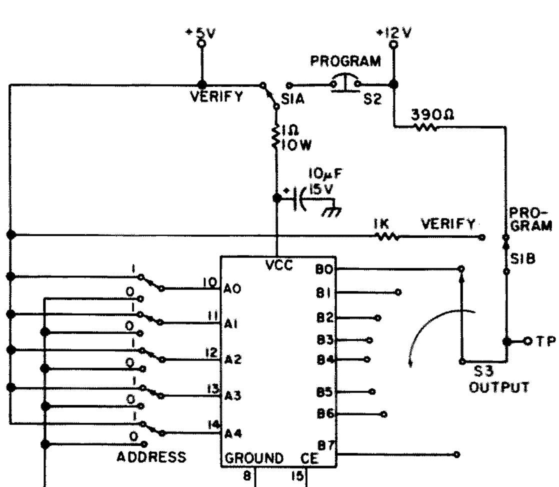

Fig. 5. Simple circuit for programming the 8223 type devices.

for programming the 74186/MCM5003 type device, I originally did it with a breadboard IC socket, 2 power supplies, and a few clip leads — it's slow but it works. The basic circuits are shown in Figs. 4 and 5.

Programming procedure is the same for both types of device. The steps are (with power applied):

1. Select word address with binary switches.
2. For that word select output bits from the program chart which are ones with select switch S3.
3. As each desired output bit is selected, momentarily depress S2. This sets a logic one in that location.
4. Select the next word address and repeat the operation. After programming, the bit can be checked by switching S1 to "VERIFY" and looking for a logic high or low on that bit.

If you decide to build yourself a programming fixture you might note the octal addressing on my programming chart (Fig. 2). It is somewhat easier to set up thumbwheel switch addressing in octal than to make the required BCD to Binary conversion necessary to address in decimal. One word of warning when programming the devices: Don't attempt to program more than one bit at a time, as you will exceed the device dissipation.

Conclusion

The memory coding for use with manual MHz switching is shown in Fig. 2 on one of my coding sheets. An SASE will get you either memory device info or the circuit for the automatic MHz switching (whichever you need). In my synthesizer the two PROMs and associated parts are mounted on a small piece of perforated board. The board is then mounted on spacers on the synthesizer board over the place where the diodes/resistors go. The code switching works perfectly. I am working on a small circuit board for this but haven't gotten it done as yet.

... W7JSW

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Peter A. Stark, "Frequency Synthesizer For 2 Meter FM," Parts I, II and III, *73*, September, October, November, 1972.

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Computers are for Hams!

During the last few years, there has been a dramatic growth in the availability of digital computers to the average person – or ham. Almost any college or university now provides computer access to its students, and many high schools now have some computer facilities. This is due, in part, to the equally dramatic drop in prices for small computers, also known as minicomputers, which range in cost from about $1500 to as much as several hundred thousand dollars. Another factor is the increase in large time-sharing systems, which make computer time available to anyone with a telephone and a paid-up account. If you can't see spending even a few thousand dollars for a mini, you can always buy a microcomputer. MITS sells its Altair model for $439, and complete kits using the 8008 chip have been advertised for under $400. If you have some of the makings, and like to experiment, you can pick up so-called microprocessor chips for under $30.

But computers are useless unless they are programmed. A computer program is like an instruction manual that the computer can use to solve the problem which you want it to solve. Computers are dumb; they can't do anything without explicit instructions. If programming scares you, there are many programs that have already been written; all that you have to do is to feed them in and start them up. But it is cheaper, and much more fun, if you write your own programs. Besides, not every problem which you may want to solve has already been written as a program.

Writing programs requires two things of the programmer. The first is an algorithm – which is simply a method of solving the problem. But as was mentioned before,

computers need very explicit instructions to do anything. Each computer understands one, and usually only one, language. This language is nothing like a human language. In fact, to a computer, a typical statement in computer language might look like this: 1 1 1 ØØØØØØ 1 ØØØØØ 1 1 Ø. That particular statement would tell a PDP-9 computer to print one letter on the teletype connected to it. If one had to write all programs like that, we would still be using slide rules to send men to the moon – if we ever wanted to try. But fortunately, someone decided to take it upon himself to write, just once, a program in this kind of form which would translate a more usable language into 1s and Øs. Once this was done, you never had to write a program in 1s and Øs; instead, you could use little combinations of three or four letters called mnemonic op-codes, usually called simply op-codes. (Try to pronounce mnemonic!) For example, the sequence of 18 1s and Øs above could be written like this: TLS. The program which does all of this is called an assembler, and you usually can get one from the manufacturer of the computer. Unfortunately, you must get a different one for every computer, and usually you must learn a new set of op-codes for every computer.

Anyway, now that we have a language that both we and the computer understand, we can take our algorithm and put it into our computer's language, feed it in, and the computer should solve the problem. Much of the commercial and scientific programming is done this way. But to write a program in op-codes is very tedious, because most op-codes express very simple ideas. Therefore, some geniuses wrote programs which would translate a high level language into op-codes. A high level language is one which even a

A SHORT GLOSSARY OF COMPUTER TERMINOLOGY

ASCII. *A*merican *S*tandard *C*ode for *I*nterchange of *I*nformation. An 8 bit code used for teletypes and other I/O devices.

Assembler. A program which translates op-codes into 1s and Øs.

Bit. The smallest unit of information – either a 1 or a Ø.

Byte. A unit of information which commonly consists of 8 bits, or one ASCII character.

Compiler. A program which translates a high level language into either op-codes or 1s and Øs.

Core. A kind of memory which the computer uses to store the program it is using and the data it needs.

CPU. *C*entral *P*rocessor *U*nit – the heart of the computer, which executes the program and does calculations.

Disk. One of the most common forms of mass storage; like a magnetic tape except it looks something like a phonograph record.

Flow chart. A diagram of a computer program in symbolic terms; somewhat like a schematic diagram of an electronic circuit.

Interpreter. A program which causes a computer to simulate an understanding of a high level language; not really a translator.

I/O device. I/O stands for *I*nput/*O*utput; an I/O device is what the computer uses to communicate with the outside world.

Mag-tape (Magnetic tape). Used to store data or programs; looks like wide recording tape.

Memory. Anything which is used for storage of data or programs; usually refers to core or short term storage.

Paper tape. Inch-wide strips of punched paper which are used to store programs for small computers or cheap ones.

Time-sharing. When several users share the computer's time. Contrasts with Batch-processing, when each user has the computer to himself until his problem is completed.

Word. The basic unit of information for a particular computer; usually one op-code. Word lengths range from 1 bit to over 60 bits.

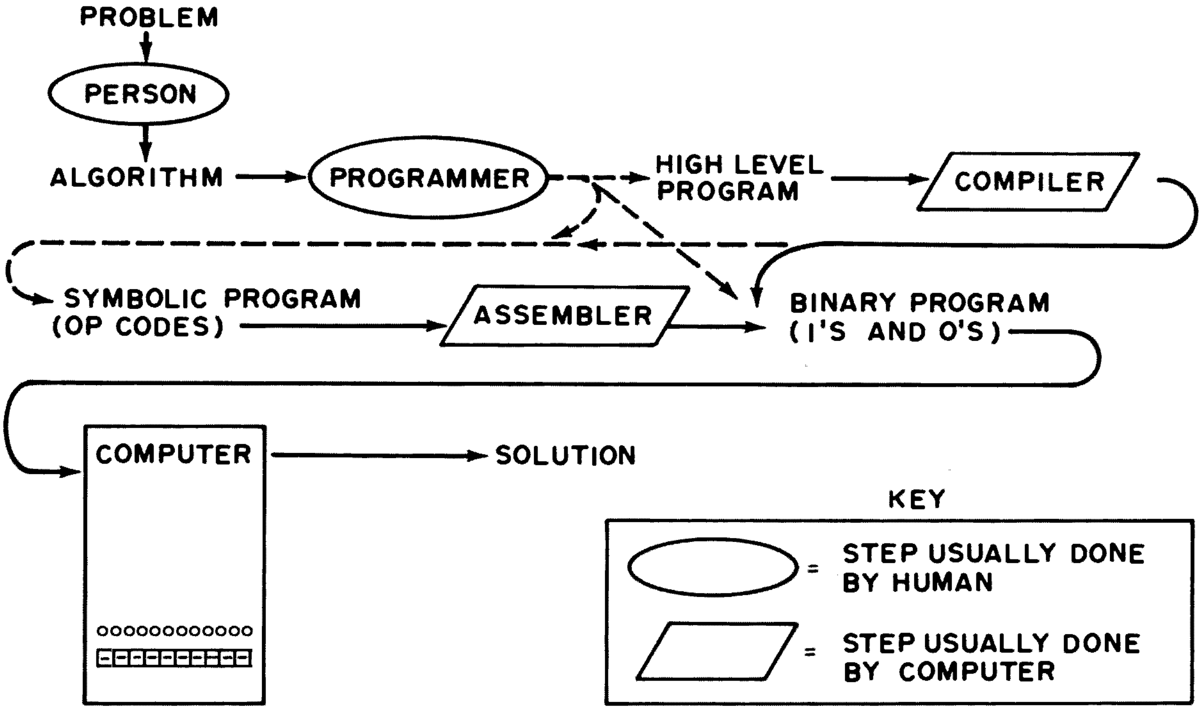

Fig. 1. Procedure for solving a problem by computer.

junior high school student can use, because it is very simple to understand. Some of the widely used high level languages are FORTRAN, BASIC, ALGOL, COBOL, APL, FOCAL, and PL/1, to name a few. In BASIC, the statement: PRINT "HAM RADIO IS FUN" would cause the teletype to print out HAM RADIO IS FUN. The same procedure would require 42 op-code instructions, or 756 1s and Øs if done on a PDP-9 computer. The program which translates high level language to op-code language is usually called a compiler.

One of the most common ways of using a computer is to use a time-sharing system. This is when anywhere from 2 to 2,000 (or even more) people are connected simultaneously to the same computer. Each person uses the computer as though he were the only one using it, and the computer is fast enough to give each user a little time every few milliseconds, so that it seems as though it is devoting itself completely to each user. This is like a movie; the pictures aren't really moving, just presented fast enough so that we think they are. If you use a time-sharing system, you will probably use a high level language, since most time-sharing systems do not allow use of op-code languages. The two simplest languages to use, and therefore most common on large time-sharing systems, are BASIC and FORTRAN. FORTRAN, which stands for FORmula TRANslation, is not as well suited to time-sharing as is BASIC, and is somewhat confusing to the neophyte programmer.

BASIC stands for Beginner's All-purpose Symbolic Instruction Code, and was the first time-sharing language. It was developed at Dartmouth College, and the primary goal of the developers was to give the programmer as easy a time as possible. Many other, more advanced, versions of BASIC have since been written, but they share the feature that a program can be written in the simplest version and be usable with any of the advanced ones. As one learns more about programming, more and more features can be added to one's computer "vocabulary." BASIC compilers are available from almost any minicomputer manufacturer, ranging from the Digital Equipment Corporation (DEC) PDP-8, at about $2000, to the Wang Laboratories $7,400 System 2200, which has the language wired into the computer itself, to the $80,000+ RSTS/E system used with DEC's PDP-11 series. (DEC, incidentally, is the biggest computer success

story since IBM – there are more of their little PDP-8s floating around than any other computer.)

So what use is the computer to the average ham, you ask? Almost any area of ham radio activity can be helped by the computer. For example, my radio club now produces mailing labels for our newsletter on the computer. We put all of our membership information onto punched cards, feed them into the computer, and out comes a gummed address label for each member. We used to sit up for several nights, copying names by hand from a list to the envelopes. With the same stack of cards, we can produce the club roster in several minutes, all set to go on mimeograph masters.

Even if you don't belong to a radio club, you can still use the computer. OSCAR users can get lists of OSCAR orbits for any area and for several years at a shot. DXers can make personalized tables of beam headings for their most important targets. Computers can print QSL cards, keep and check contest logs, predict spurious outputs for FM-27s, predict receiver birdies[1], coordinate DX hunting[2], design and test new circuits, graph antenna patterns and produce the Callbook. I have heard about repeaters that are completely controlled by a microprocessor. The computer can solve virtually any problem which requires the manipulation of numbers or data. I doubt if anybody has tried, but it should be possible to have computer chess tournaments over RTTY or slow scan TV. Some chess-playing computers, like Chess 4.0 of Northwestern University, have achieved high intermediate ratings.

It makes little sense for every ham to write his own programs for every problem he wants to solve ... in fact, there are many organizations which already exist for the sole purpose of exchanging programs between programmers. For example, Digital Equipment Computer Users Society (DECUS), sponsored by DEC, provides such a service. Catalogs of programs are sent free to members, and paper tapes of programs are available for little cost. Members contribute programs and articles to the society magazine, DECUSCOPE. DECUS holds conventions several times each year. Within DECUS are many Special Interest Groups (SIGs), which appeal to smaller segments of the programming fraternity. There is room for a Radio Users Group (RUG?). DECUS will provide, for free, certain services for any SIG, such as mailing and printing of newsletters. Perhaps some organizations, like ARRL or IARU, could get together with DECUS and support a RUG. Other computer manufacturers, MITS for example, already provide similar services for their customers, but there are considerable advantages in having one organization handle all amateur programs. Although most programs are only usable on one computer, the algorithms behind them can be translated into any language. Algorithms are sometimes expressed in "flow charts," and these flow charts can be exchanged as easily as programs. I think that, in the future, articles in ham magazines on computer programs will be as common as construction articles, and programs will be distributed in the same way that printed circuit templates are.

I hope that this article has given you some idea of what the computer's place in ham radio is, and perhaps removed some of the mystery which shrouds the computer and its uses. The computer has been described as the most important technological innovation of the twentieth century, and although we all know that radio is more important, we can certainly give the computer a good shot at second place. We have nothing to lose but our slide rules!

...WA1PAZ

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The Unzapper

A keep-alive circuit for yourself.

Whenever you use an electric power tool or any electrical device for that matter, you expose yourself to the possibility of a fatal electric shock by coming in contact with faulty wiring and providing a path through your body to any surrounding grounded surface. Most wiring in homes now makes use of grounded three wire outlets to insure the extra conductor to protect against a drill or other electrical equipment from becoming shorted by tripping the circuit breaker. However, this is no 100% guarantee of safety since the return ground conductor could become faulty without your knowledge (bad connections, etc.). For this reason, the new National Electric Code is requiring Ground Fault Interrupter circuits to be installed on all outdoor circuits and bathroom circuits in new homes. This new requirement is doubly important for outlets near swimming pools or outlets used for lawn tools and power tools.

A Ground Fault Interrupter (GFI) is a device which continuously monitors the current balance in an ungrounded conductor with the current in a neutral conductor in order to protect the user from ground faults. If the current in the neutral conductor is equal to that of the hot conductor, a ground fault condition does not exist since this is the normal operation of a load connected to the circuit.

However, if the current in the neutral wire becomes less than the current in the hot wire, then a ground fault exists, because a portion of the current is finding a return by an unintended path such as a leaky electrical appliance or tragically, through an

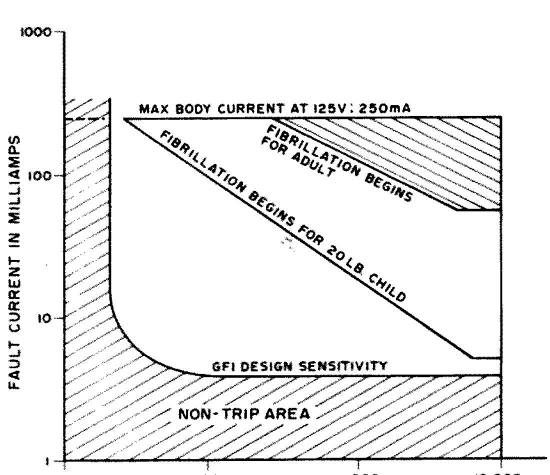


Fig. 1. For an adult, as little as 60 mA of current can cause fatal fibrillation of the heart. The GFI described in this article has a sensitivity of 4 mA. (Graph courtesy Pass & Seymour, Inc.)

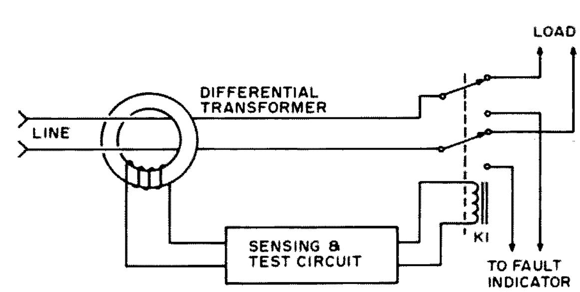
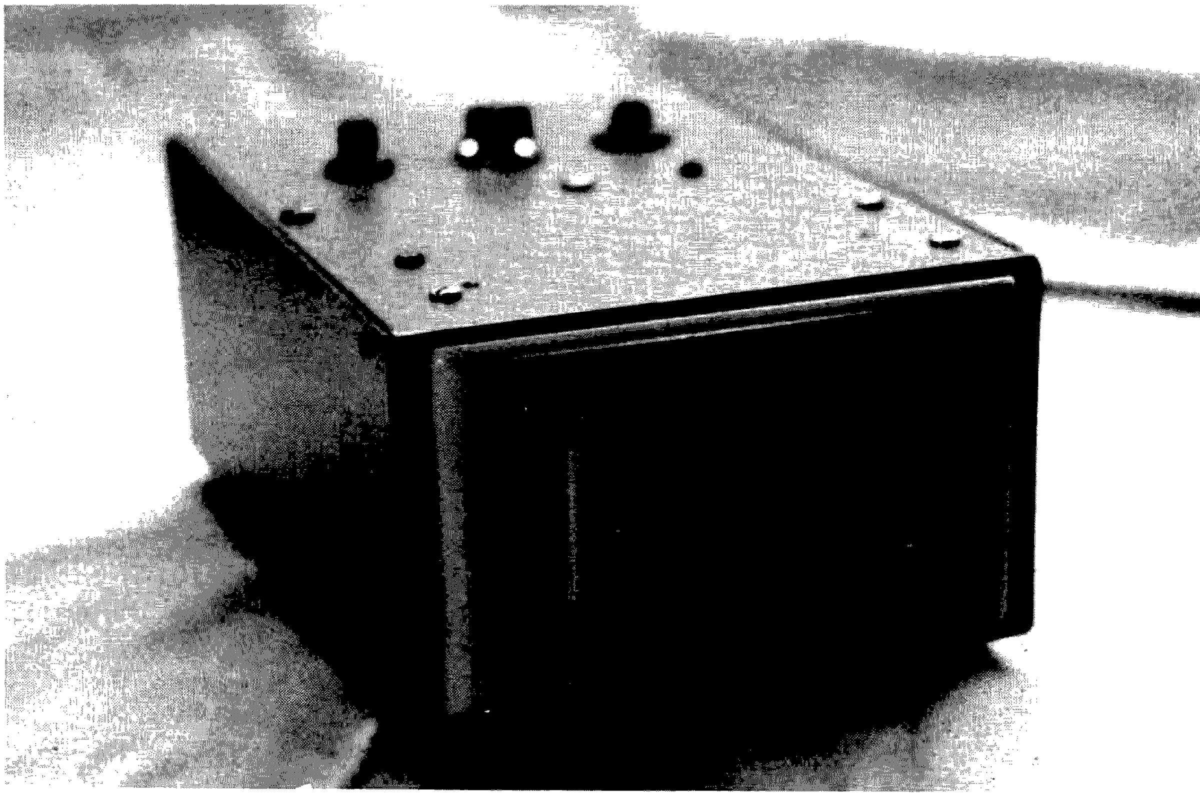


Fig. 2. Current leakage to ground on the load side causes an imbalance in the circuit. The resultant induced voltage in the toroid is amplified and used to actuate relay K1. The GFI does not depend on a third wire ground and incorporates a built-in test circuit for periodic checking.



Front view of the GFI.

individual. The GFI device will detect this situation and operate a relay which disconnects the power going to that particular load fast enough to protect the individual.

To understand the nature of a fatal electric shock, we refer to the graph shown in Fig. 1. This graph indicates that the maximum body current that an individual can withstand at 125 volts is 250 milliamps. It also indicates that muscle control leading to a fatal condition occurs at approximately 8 milliamps for a small child and up to approximately 60 milliamps for an adult. From the graph, it's also possible to see that the GFI device described in this article has a sensitivity of 4 milliamps and will operate within 30 milliseconds to prevent the current from ever appearing in the hazardous portion of the curve.

Fig. 2 is a simplified diagram of the basic operation of a GFI system. It consists basically of a sensing differential transformer, the sensing and test circuit, and a relay to de-energize the main circuit. Current leakage to ground on the load side causes an imbalance in the transformer circuit. The resultant induced voltage in the toroid is amplified and used to actuate an SCR which controls relay K1. From the basic diagram, it is possible to see that the GFI device does not depend on a third wire ground system. It also incorporates a built-in test circuit for periodic checking. There are two basic commercially available models of GFI devices, one that installs directly into an outdoor outlet. There are also commercial models available as portable units that may be plugged into standard circuits without the necessity of rewiring the house circuit.

This article describes a method for the amateur to construct a GFI device which is portable and can be used in many different situations. It is exceptionally applicable to amateur electronic installations where many of the devices in use have metal enclosures which could present a shock hazard to the amateur. It may also be used in conjunction with transformerless power supplies to prevent fatal shock conditions should the amateur come in contact with various portions of the circuit.

Circuit Description

Referring to Fig. 3, one of the main elements of the circuit is a toroid transformer, T1, which consists of a two-wire

primary circuit and a secondary circuit used to sense the unbalanced condition. The actual details of the winding of this transformer are contained in a later section of this article. Resistor R1 is connected in such a way as to provide a 4 milliamp imbalance in the primary circuit used to simulate actual ground fault conditions for testing the circuit.

Resistor R2 and C1 form a filter circuit to help suppress spikes which may appear on the secondary side of the transformer from turning load equipment on and off. This eliminates tripping of the relay under these conditions, while having a negligible effect on normal operation of the circuit.

The integrated circuit, IC1, is an operational amplifier type 741 which is used to amplify the small voltage generated in the secondary winding of transformer T1. The gain of this operational amplifier is determined by the ratio of R5 and R6 expressed as follows:

$$\text{GAIN} = \frac{R5}{R6}$$

In this particular circuit, with R5 set at one megohm and R6 @ 2.7k, the gain is well over 300. However, the actual gain is limited by the input gain control, R3. A gain of 300 should be sufficient to fire the SCR, since it requires approximately 0.8 volts to trigger its control gate. With an imbalance of 4 milliamps on the primary of T1, approximately 3 millivolts appear across the secondary winding connected to the input of IC1. Since the gain of the op amp is set at 300, about 0.9 volts appear on the gate of the SCR which is sufficient to trigger it and cause relay K1 to operate. Once the SCR triggers, the circuit must be broken manually for it to reset. The reason for this is that we are supplying power through the relay coil to the SCR from a dc source and due to the nature of the SCR, this dc path must be broken before the SCR will turn off and restore the circuit to normal operation. Since the 120 V ac output is supplied through double-pole double-throw relay contacts, when the relay operates, the 120 volts ac is transferred from the output of the unit to a neon indicator light making it possible to see that the unit has operated and the power has been turned off.

Diodes D1 and D2 also work in conjunction with the RC filter circuit to reduce transients that would cause false triggering of the unit. These diodes should be fast acting switching diodes such as the 1N914 type.

A parts list and PC circuit board details are contained in Figs. 4 and 5 respectively.

The basic components such as the integrated circuit, SCR, and other small components are located on a circuit board as shown in Fig. 6. The toroid transformer,

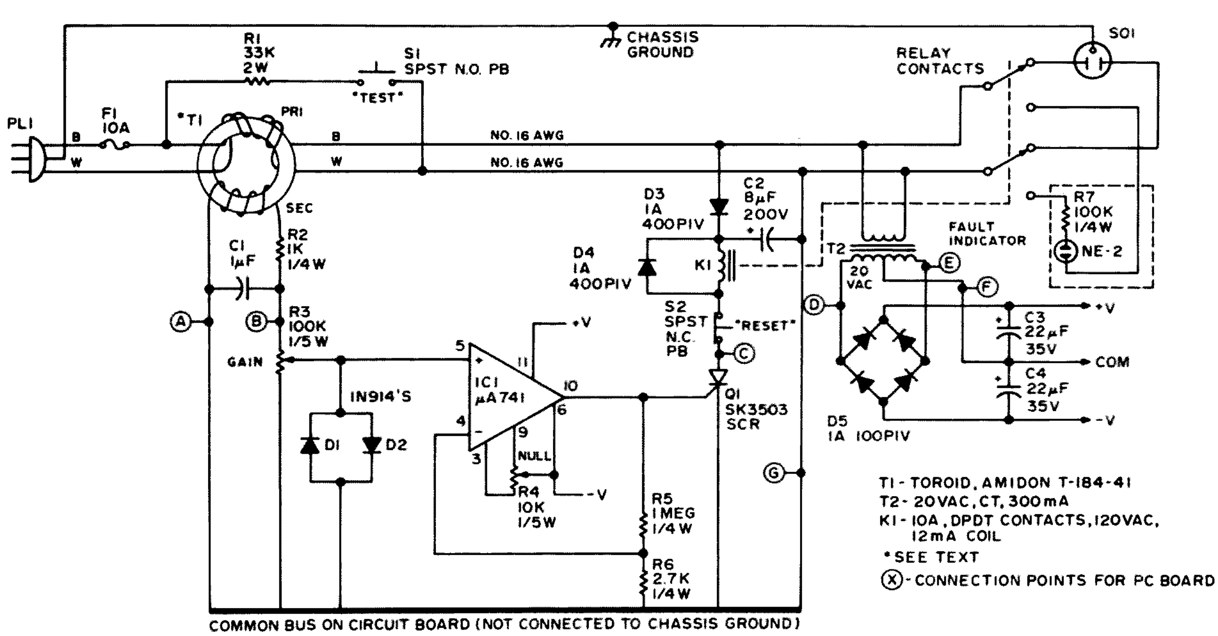
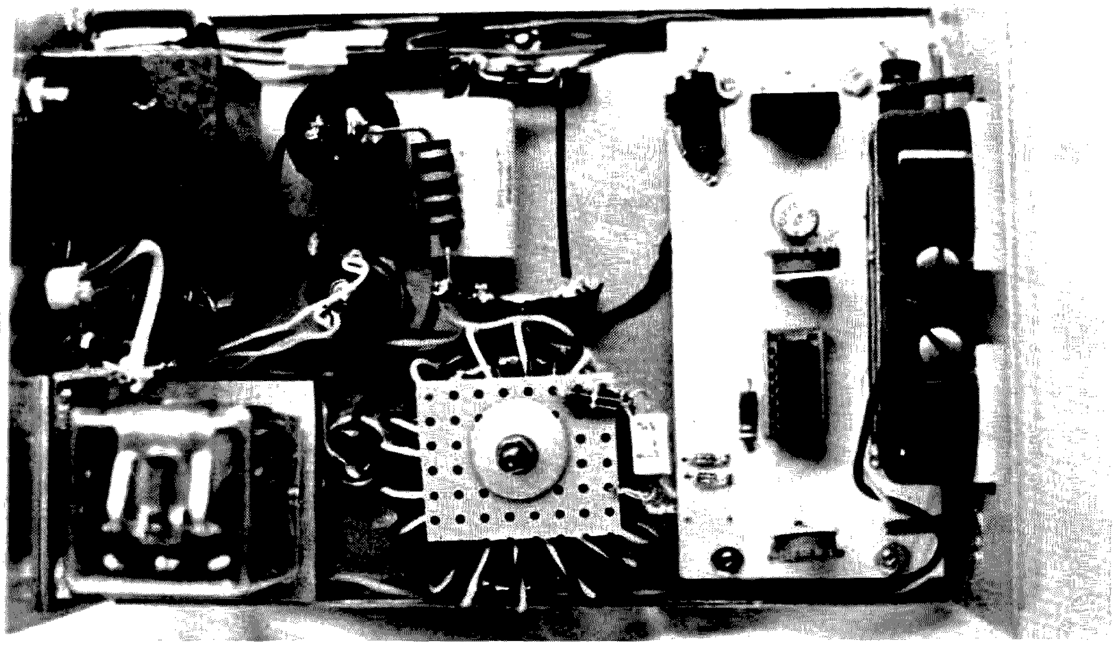


Fig. 3. Schematic diagram.



Top view.

relay and power supplies are located externally to the circuit board and connected by suitable wiring as shown in the diagram. It is important to note that the ground conductor from the ac supply should be connected directly to the metal chassis of the enclosure. However, since we are using a transformerless power supply to operate relay K1, it should also be noted that the common bus on the electronic circuit is not connected to the chassis ground of the enclosure.

I used a 3" x 7" x 5" enclosure which allowed ample room for the location of the power supply, relay and circuit board along with toroidal transformer. The relay used was a plug-in type, available at several of the surplus suppliers advertising in 73. The relay should have a 120 volt ac coil with contact ratings of approximately 10 Amps. The physical location of the parts is shown in Fig. 7.

Toroid Transformer Details

The heart of the unit is the toroidal transformer T1 which is used to sense an imbalance in one of the main conductors of the primary circuit. The toroid which I used is an Amidon Associates type T-184-41 iron toroid core. This toroid core has an inside diameter of 1.84 inches and is light green in color.

The secondary winding of the transformer consists of approximately 600 turns of #30 enamel wire covering the entire circuit of the transformer. While this appears at first to be a very tedious operation to wind this many turns on the toroid, there is a method of winding it in a very short period of time. In my particular case, I used the enamel wire obtained from a peaking coil from the television set. This wire appears to be approximately #30 gauge and is ideal for winding the secondary of T1. The TV peaking coil has a certain amount of adhesive to keep its windings in place and acts as an excellent bobbin for running the secondary turns through the transformer. The actual winding time for the secondary on my particular transformer was approximately ½ hour. If you should lose count of the number of turns, the secondary should have a dc resistance of about 30 Ohms.

After the secondary of the transformer has been wound, wrap the entire transformer with black vinyl electrical tape to protect the small diameter conductor.

The primary consists of 12 turns of #16 solid conductor twisted pair wire. I used one black and one white wire conductor to

Parts List

C1 – 1 uF, non-polarized
C2 – 8 uF, 200 V
C3, C4 – 22 uF, 35 V
D1, D2 – 1N914 or equiv.
D3, D4 – 1 Amp, 400 piv rectifiers
D5 – 1 Amp, 100 piv bridge
IC1 – uA741 operational Amp
K1 – 10 Amp, DPDT contacts, 120 V ac, 12 mA coil
Q1 – SK3503 SCR or equiv.
R1 – 33k, 2 W
R2 – 1k, ¼ W
R3 – 100k, 1/5 W trim pot
R4 – 10k, 1/5 W trim pot
R5 – 1 meg, ¼ W
R6 – 2.7k, ¼ W
R7 – 100k, ¼ W
S1 – SPST, N.O. push-button switch
S2 – SPST, N.C. push-button switch
T1 – Toroid, Amidon T-184-41 (see text)
T2 – 20 V ac, CT, 300 mA
Miscellaneous – three prong ac plug and line-cord, socket, enclosure, fuse and fuse holder

Fig. 4.

conform to the color coding of the National Electric Code and to help to keep the polarity of the entire system in accordance with the wiring throughout the house. The 12 turn twisted pair primary winding is spread out over the entire transformer to get maximum flux linkage to the secondary. By winding the transformer in this manner, it is possible to see that the current in both conductors of the primary winding should be equal under normal circumstances and since they are twisted together, should cancel out completely within the toroidal transformer. Also, if an imbalance exists between the conductors, this imbalance will be sensed by the secondary winding and produce an ac signal which can be amplified to trigger the SCR. The secondary winding produces an output of approximately 3 to 4 millivolts when there is a 4 milliamp imbalance on the primary. This voltage output is sufficient to operate the SCR when amplified by the integrated circuit amplifier.

To mount the transformer, use 2 small squares of perf board with a hole drilled in the center for mounting onto the enclosure. Once the toroid is sandwiched between the 2 pieces of perf board, it is possible to install the mounting bolt and tighten the boards down for permanent installation. Then the small secondary wire can be fed through a couple of the holes on the top portion of the insulator, and soldered to terminals installed at this point. The RC filter consisting of R2 and C1 can also be mounted on the perf board and the output from this filter brought down to the input of the amplifier with regular hook-up wire.

By using a circuit board mounted to the transformer as a connection point for the secondary, it is possible to avoid any problems with breaking the very small enamel wire which has been used for the secondary to transformer.

Conclusion And Results

Once the GFI has been constructed and

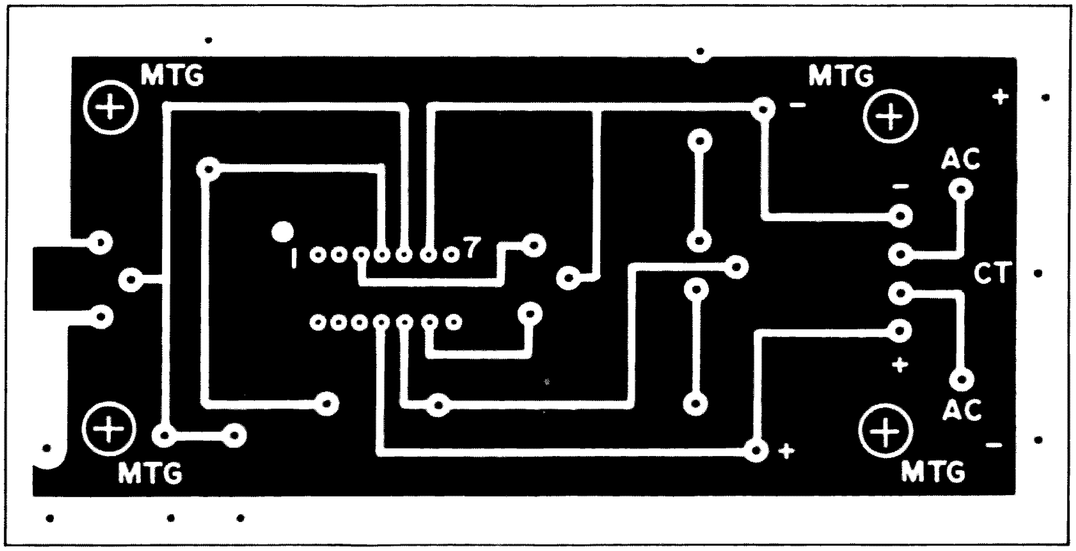


Fig. 5. Printed Circuit Board Layout (full size).

operating, there are only two minor adjustments which have to be made. First of all, the null adjustment, R4, should be adjusted so that there is zero voltage between the output terminal and the common bus during idle conditions. This is necessary to prevent false triggering of the SCR.

The next step is to adjust the input gain of the unit for proper operation. By depressing the test button, it is possible to introduce simulated fault condition. While holding the test button down, advance the gain control R3 until the relay operates. You may want to advance the gain somewhat further to provide even more sensitivity on the unit. Since most commercial units operate with a 5 milliamp sensitivity, any sensitivity greater than this provides that much more protection for the user. However, if the gain is set too high, it may result in nuisance tripping by spikes, and transients that are not controlled by the filter circuits.

In actual operation, it is best to test the circuit before each use to make sure that the circuitry is operating and will protect the user from ground fault conditions. This is done by depressing the test button and seeing if the unit operates to remove the ac from the outlet. Then by pressing the reset button, the circuit to the SCR is broken and the relay returns to its normal position.

It should be obvious from the circuit and discussion that this unit protects the user only from "ground fault" conditions. It will not protect an individual if he gets directly across the power line.

The circuit is also designed for a 3 wire system, but will operate satisfactorily on 2 wire systems since it detects any type ground leakage whether it be through the ground conductor operating the unit, a ground path through a water pipe, or any other metal conductor that travels back to the grounded conductor of the power system.

I am sure that there may be some improvements to the circuit that I have not incorporated at this time. Perhaps, it may be possible to tune the toroid to 60 Hertz and thereby greatly increase the sensitivity of the T1 transformer. However, I have not investigated this possibility at this time, and would be interested to hear from anyone who has

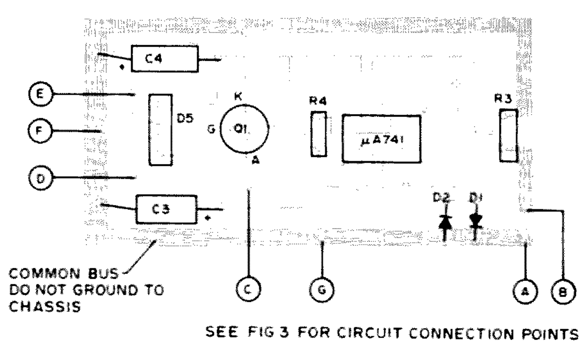


Fig. 6. Connection of Components External To PC Board.

had experience with toroidal transformers concerning this type of circuit. Perhaps if the transformer was resonant at 60 Hertz, fewer turns on the secondary winding would result in satisfactory operation of the circuit. At any rate, the unit as described could save your life, and that's its most important feature.

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National Electrical Code — 1975 Edition, pg. 31, paragraph 210-8.

Pass & Seymour, Inc. — Syracuse, New York 13209, brochure #3375.

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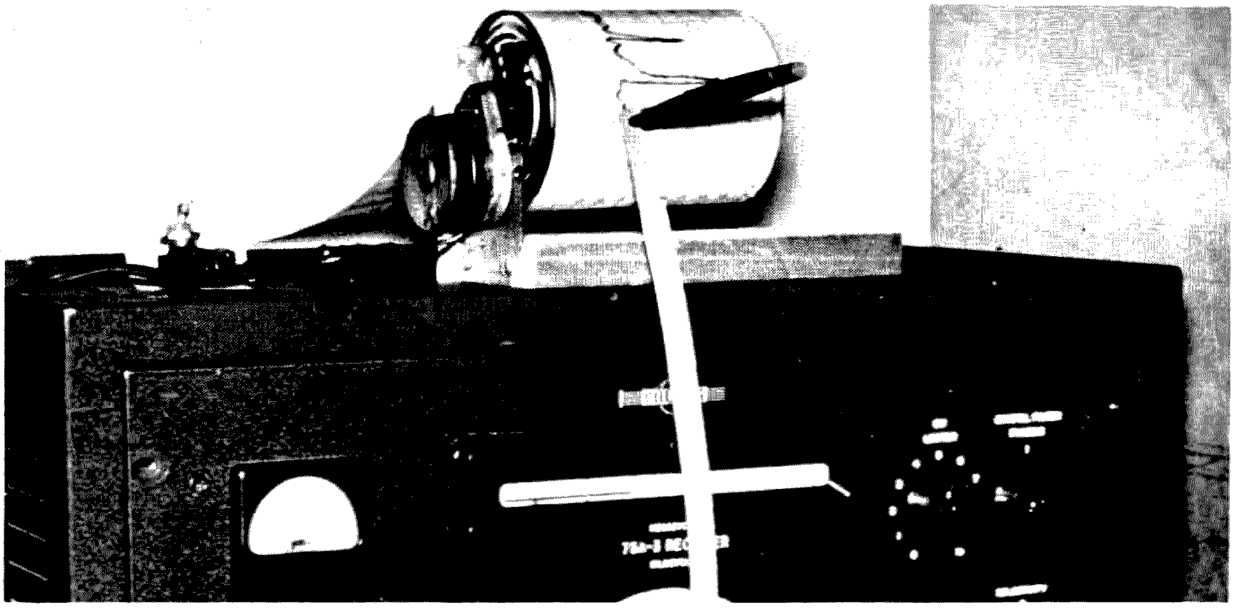
A $1.00 Strip Chart Recorder!

In many instances a recording of a change against time can be of value in examining cause and effect. With recorders costing more than a hundred dollars, this advantage is not available to most amateurs.

The strip chart recorder described, while of less than commercial stature, cost the writer about a dollar, has served its purpose very well, and can be an interesting exercise in utilizing commonly possessed or available parts. The variations possible are myriad: direct clock motor drum drive, or through pulleys for mechanical reasons or to obtain the desired paper speed from an available motor. Similarly, the chart can be tensioned and paid off from its drum by simply attaching the loose end of the chart to a weight, or a more elaborate take-up may be devised by using another drum with an overriding rubber band slipclutch drive.



The choice in construction is facilitated by the wide range of drums available in practically every household – empty tin cans.

As an application example, the photo shows such a recorder mounted above the main tuning dial of a receiver to record frequency deviations. The drum is an empty tomato can, 3¼" diameter, overhung from a 1 rph clock motor shaft, giving a chart speed of 10"/hr. The tuning dial motion is carried to the recorder pen by a hacksaw blade, which is ideally springy in the line of the pen, while being quite rigid laterally. The recording is made by constantly adjusting the receiver for zero beat, if the strength varies. If the signal strength is constant, a preferred method is to tune for a constant "S" meter reading on the side of the band pass skirt. The chart is attached to the drum with tape and prewrapped about a half dozen times. The loose end of the chart hangs over the back of the receiver and table, and is weighted to take up the slack as the chart is paid off the recorder drum.

It is obvious that the receiver dial in the photo could be replaced by a variable resistor (pot) in a simple bridge circuit to record voltage or current, the XYL observing the bridge balance meter, preferably with a fixed magnifying glass, and adjusting the dial on the resistor to hold the balance meter constant. (She might go on from this to learn the code and theory and get a ham or driver's license??)

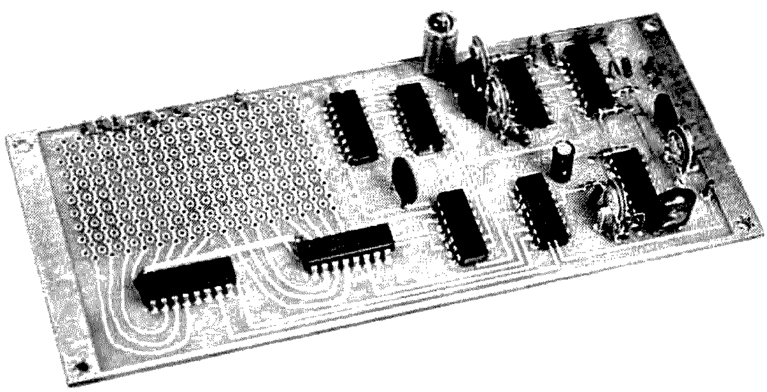
For convenience and a further exercise in applying junk box components, the bridge unbalance may be electrically sensed and used through an amplifier and small gear-motor to keep the bridge pot balanced and thus drive the recorder pen, as it is well known that many of the commercial recorders do. The January, 1975 issue of *Scientific American* shows such an arrangement of the do it yourself variety.

The paper for the recorder may be cut from rolls of regular recording chart paper. If lines are not deemed necessary, plain paper or adding machine tape can be used. Pens can range from commercial recorder pens to fountain, ball or felt tip.

. . . W6NLB/7

NEW PRODUCTS

VHF Eng. CW ID Kit



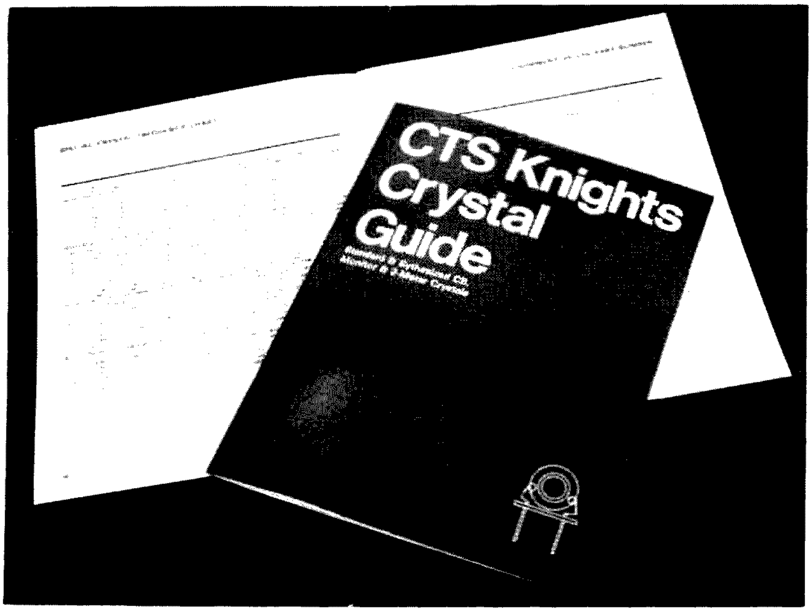
A CW ID kit for commercial or amateur repeaters has just been announced by VHF Engineering of Binghamton, New York. The CW ID kit consists of high grade components, drilled epoxy glass circuit board, programming diodes, and can be built in approximately one evening by amateurs with nominal building experience.

This new CW ID from VHF Engineering presents a price breakthrough for the amateur. The kit price is $39.95, plus postage. Sufficient diodes are included to permit programming of virtually all repeater calls. Programming is accomplished in an easy manner by soldering diodes directly to the matrix board. Diodes are placed on the board

in a straight line fashion using three diodes for a dash, one diode for a dot, and no diodes for a space. Programmed calls may be changed at will merely by rearranging diodes on the board. Additional flexibility is provided since the unit may be programmed in either CW or RTTY code – thus this IDer may be used for automatic identification of any RTTY station.

The CW ID is also available wired and tested for $49.95, plus postage. VHF Engineering, 320 Water Street, PO Box 1921, Binghamton NY 13902.

...W1HCI



CTS KNIGHTS PUBLISHES NEW 72-PAGE GUIDE FOR CRYSTAL SELECTION

CTS Knights, Inc., has announced a new 72 page Crystal Guide which lists all standard CB, synthesized CB, monitor and 2 meter amateur crystals that are available from CTS distributors and dealers. All CTS crystals are gold calibrated to assure ultrastable frequency ... for clean, crisp reception all the time.

Included in this complete guide to crystal selection are CB cross reference charts ... monitor and 2 meter equipment vs. CTS part number listings ... frequency charts for standard and synthesized CB crystals, as well as general information about each crystal type.

CTS crystals are available in color-coded packages to make it easier to find low band, VHF or UHF monitor crystals. Most all are in distributor stock or can be ordered directly from CTS Knights by sending a convenient certificate to the Company.

A free copy of "CTS Knights Crystal Guide" is available from Bill Doede, Distributor Sales Manager, CTS Knights, Inc., 400 Reimann Avenue, Sandwich IL 60548. Phone (815) 786-8411.

Clyde E. Wade, Jr.
312 S. Cedar
Little Rock AR 72205

An Even Simpler Clock Osc.

Many articles have appeared in *73* and other magazines in which crystal oscillators used either two sections of a TTL hex inverter or two sections of a TTL quad NAND gate such as the SN-7400. Since a TTL quad AND gate (SN-7408) is also available, and the output of a section would be in phase with its input (with the other input held on), I wondered if a crystal oscillator could be designed using only one section of a SN-7408. This could result in circuit simplifications – especially if the remaining sections are used elsewhere. Or you could use all four sections for four crystal oscillators.

Fig. 1 shows the experimental circuit that I came up with, and it seems to work fine. The crystal must be specified for series resonance and 30 pF series capacitance with the values shown. A parallel resonant crystal will not operate on frequency. The 1k pot is a little screwdriver adjust type, and it's adjusted for reliable oscillator starting or, if (and only if) you have a good *wideband* scope, it's adjusted for symmetrical square wave output. The diodes may be either 1N34As or 1N914s. I used 1N34As. They seem to improve oscillator stability.

The "gimmick" is a very small capacitance formed by wrapping an *insulated* wire around the output lead a time or two. This capacitance makes the square wave "squarer." If you should experience weird oscillations, reduce this capacitance a bit.

...WADE

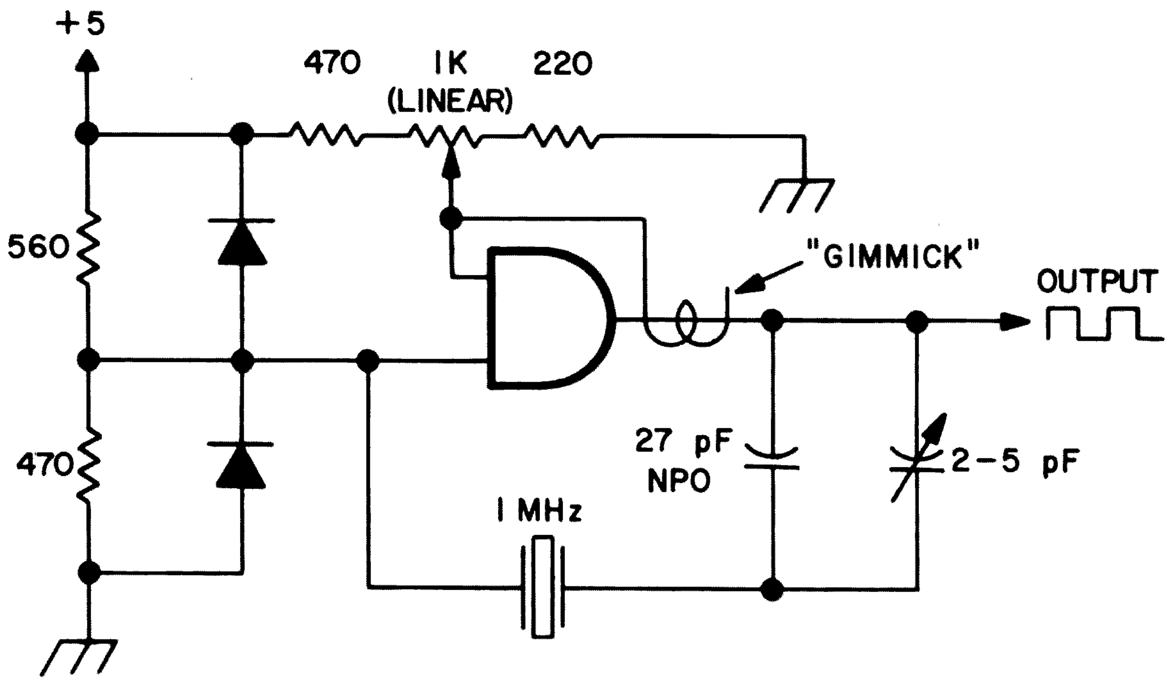


Fig. 1.

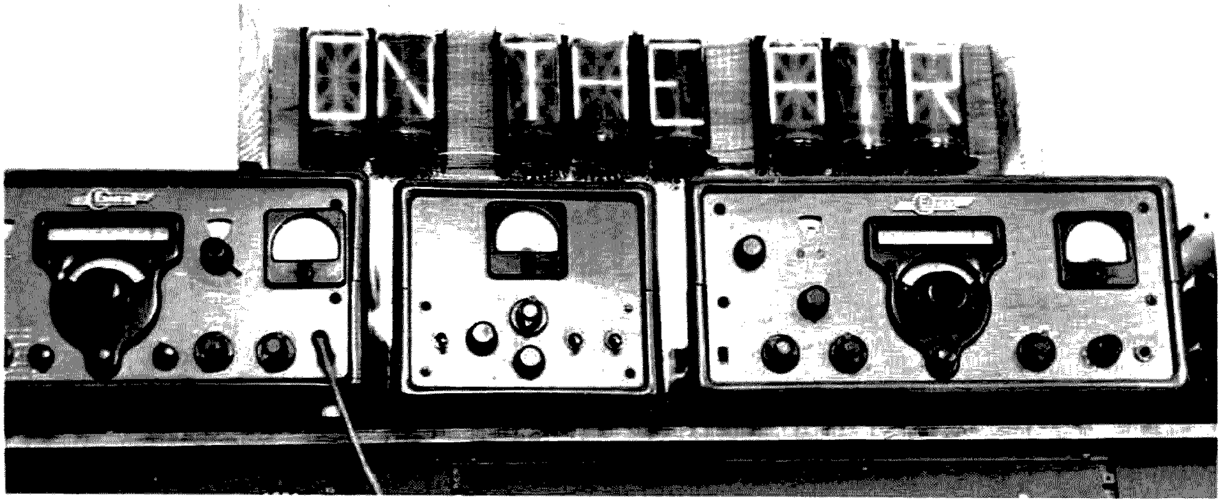
Jack Grimes W4LLR
Box 16004
Memphis TN 38116

Display Yourself in a Big Way

Have you ever had a yen for one of those fancy, high priced ON THE AIR signs that give forth a bright glow when you hit the big switch? Or maybe have you wished for a super-attractive call letter display?

How often have you searched for a house number on a dark night, and, even with the aid of a flashlight, made your way to half a dozen doors before locating the right address?

Wouldn't it be nice to surprise the XYL and dress up the doorway of your place with nice, bright, two and one half inch numerals? Or if you would like to add a different touch, how about spelling out the



number in block letters that shine with a golden glow?

Perhaps you own a business or moonlight with a repair service and could use an eyecatching sequence of letters and numbers to inform the waiting public of your availability.

Or, for you tipplers, how about a friendly bit of neon advising: "Bar is Open"?

If you are interested read on and learn how simple and economical it can be to create your own displays. Chances are if you complete one project, soon you'll have the whole place all lit up!

There is nothing in ham radio more pleasurable to me than finding a worthwhile use for a genuine surplus bargain. One item presently readily available at a low price is the giant alpha-numeric tube, B-7971. Not only are the tubes available from $1.00 up, but also offered, in pairs, are sockets plus tubes on a board with resistors, transistors and diodes, for as low as three pairs for $5.00.

Use the tubes and sockets for a six letter display and you will still have a solid $5.00 worth of parts for the junk box, saved from the boards.

The actual construction of a display is so simple that Figs. 1 and 2 are almost self-explanatory.

The power supply is a simple half wave, line voltage rectifier with a minimum amount of filtering. Values are not critical, except that the diode must handle the ac line voltage and the filter capacitor be of high enough voltage rating for the 150 volts dc output. No bleeder is necessary, but the 1 M resistor was included to slowly discharge the filter when power is removed.

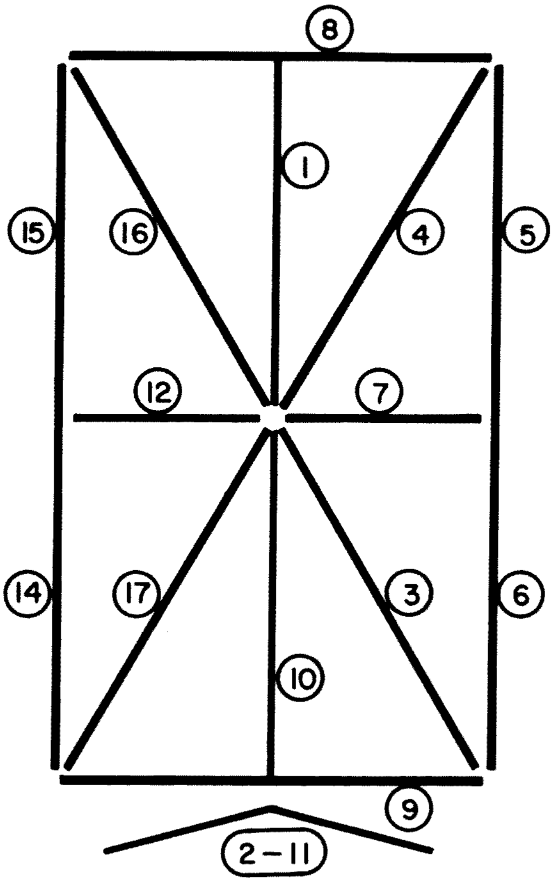


Fig. 1. Pin connections for B-7971 nixie readout. Pins 2 and 11 internally connected (used only for decorative purposes if desired). Pin 13 is anode (+voltage). The actual size of each alpha-numeric nixie character is 2½" high by 1½" wide.

The anode (pin 13) of each nixie is fed through a 3,300 Ohm resistor. If a higher voltage supply is tapped, a higher value resistor must be substituted. With 300 volts the resistor should be 68,000 Ohms.

Refer to Fig. 1 to program each nixie. Simply pick out the segments you need to light, to form the desired letter or number. Connect those pins together and wire to the negative terminal of the power supply. It is

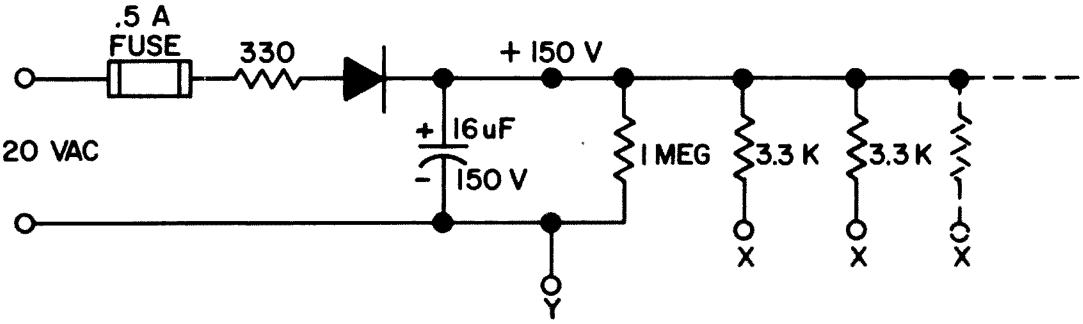
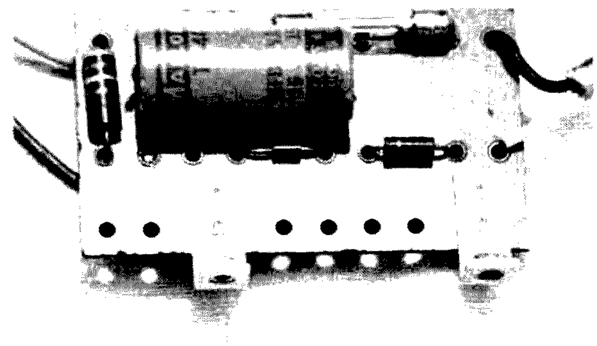


Fig. 2. Simple power supply for the giant nixies. Connect a 3,300 Ohm resistor from +150 V to pin 13 of each nixie. Connect each segment to be lighted to point "Y" (−150 V).



Simple power supply.

not recommended that the negative line be grounded to the brackets or chassis or cabinet, as this point is directly connected to the ac source.

If you purchase your nixies in pairs with the sockets and boards you will find the tubes mounted end to end on an aluminum bracket. It is quite simple to mark and hacksaw the brackets in half at the center. They may then be mounted on a wooden strip or metal angles and spaced as desired.

Your final housing may be as elaborate or simple as desired, from a highly polished wood cabinet hung with brass chain for your bar, to a panel mount for the shack. The giant nixies will draw only about 2 mA per tube at this low voltage. The current drain is so minute that leaving house numbers lighted 24 hours will put no strain on the pocketbook, even if the XYL decides to be fancy and spell out the numbers rather than use simple numerals.

The giant nixie is a tremendous bargain. Its suggested use as a fixed display is in no way meant to downgrade its performance in various multiplexed arrays such as clocks and counters. However, for these projects, adequate interfacing with expensive and hard-to-get parts is required.

By using the tubes as set forth in this article any combinations of words and numbers may be produced at a fraction of the cost of other neon displays.

And the same setup can be reprogrammed when desired, in minimum time at no additional cost.

. . . W4LLR

J. K. Bach
Ivy Hill Road
Walden NY 12586

Fun City's Surplus Scene

There is a shortage of surplus. This is not meant to be funny. Nowadays a surplus ad often means they want to *buy your* surplus, not sell theirs. The exception is the venerable Command Set, available since WW II. The government must have ordered one for every man, woman and child in the country.

We surplus hounds have never been understood. Our severest critics themselves buy antiques and nostalgia items, some pretty gamey. Their more extravagant purchases are justified on the basis of historical significance – Paul Revere's megaphone, Death Valley Scotty's skis, or whatever.

Amateur interest is now mostly in integrated circuits and readouts, so industrial surplus has replaced military almost entirely. And these needs are best taken care of by mail-order specialists. Mostly they are slow,

but all are reliable.

There are many surplus emporia scattered around the country – probably one for each large city. Kingston, New York has P & D Surplus. Philly has Herback & Rademan. But the mecca is New York City.

Those of you who live within range, or visit the city for other reasons, may plan to drop by Radio Row and actually handle and examine the stuff before buying. This is a good plan since you will see many *one-of* items, and many others new to you, about which the proprietor will be glad to furnish specs and answer any answerable questions.

Back in 1969 I wrote a thing on the surplus scene. Radio Row had just been relocated to make room for the World Trade Center, a complex of skyscrapers then building. (In mid-May of this year, some patriot set three fires in one of the buildings, doing extensive damage, for obscure reasons.) Before the WTC, Radio Row was mostly Cortlandt Street, with spill-overs from Liberty to Dey. It has now moved to Warren Street as an axis, with a scattered few elsewhere. Canal Street is growing and may outshine Warren in a few years.

Before making any plans, if you are unfamiliar with New York, it might be well to know something about the magnificent distances in that city. Manhattan is all one borough, but the Cloisters, the museum/Planetarium complex in the 80s, Central Park, Wall Street, Chinatown – in your community, they would probably be in separate towns, that's how far they are apart. NYC is *big*. It is unrealistic to plan seeing more than one or two of them in a day. I can spend a week in the museum alone, if my legs would stand up. Their arms and armor section is fabulous! The knights of old were shrimps, most of them, judging by the armor they could get into. And tough shrimps, too, since the armor was heavy.

Taxis? Catch them at their roosts, like sitting ducks. Flagging one is like flagging a pigeon.

Subways? The whole population rides them. Rush hours resemble the march of soldier ants. By the time this sees print, the fare may be raised again, but it is 50¢ at the moment.

The city administration loses money on the subways. No one else could, but New York is headed for bankruptcy.

Your first glimpse of a subway car will startle you. The cars are covered, inside and out, by Psycho-Delicatessen Graffiti, like dazzle-painting, or camouflage, so that you can't even find the train designations. The cars used to have "A" or "D" on front and sides, but the trainmen don't bother anymore. You have to ask a native rider, who recognizes his train by smell or ESP or something. In the rush hours, which start as early as 4 pm, you could get your pocket picked, but there is little or no danger of violence.

New Yorkers have their own code of conduct. Perhaps every city has. Anyway, they will never allow a door to slam in your face. Step on it, yes, but never let a door slam in it. In other cities your fellows will punt you into the lobby with one. Another thing: New Yorkers are very patient about giving directions. In broken Croat, maybe, with a lot of arm waving, but their concern in getting you headed right is heartwarming.

Subway trains take different routes on regular as opposed to rush hours, so you may wind up far from your expected destination. There are maps inside the cars, but don't expect them to help you. They require study.

If you get carried past your stop, don't panic. All you have lost is time. Wait until you get to a *big* station, cross over to the other side via platform or stairway, and head back the other way. A small station will exit on the street; you must cross and pay another fare. Don't cross the tracks! It has a third rail. People get killed. This rail is outside the main ones, not in the center like Lionel.

Passengers have been Pavlov'ed to enter and exit cars briskly. All you have to do is stand in the crowd and be swept aboard without effort on your part. When you ride, avoid the doors, or you may be left outside on some platform without ever knowing how you got there.

There are many more subway cops than there used to be, and subways are presumably safer. They should be avoided late at night, however.

Warren at Broadway, facing east.

Incredible as it seems, Manhattan was once a place of white wooden houses and shady lanes and cornfields. Oh, it was a city all right, but on the 1900 model. The story goes that in the early years, a promoter proposed that some rather drastic changes in the physical makeup of the island be implemented. He announced that he was going to hire a thousand men to dig pits, another thousand to handle cross-cut saws (the big, double-ended jobs), and more thousands to man push-poles on the river-banks.

He planned nothing less than to station sawyers in the pits, which were to be dug along Fourteenth Street (then a dirt lane), who were to saw that end of the island free from the rest. The pole men would push it out in the bay and anchor it there. Besides high wages, he offered free food, including steamed clams and barbecued oxen and a small ocean of beer. Fantastic as it sounds, the idea has merit.

On the appointed day, an army of indigents showed up, together with the various contractors including butchers, fishmongers and brewers, reporters, spectators and police. Only the promoter was missing. When the unpaid suppliers began to reload their wagons, the picnic turned into a riot. The lower end of Manhattan is still firmly attached.

Hoaxes are no longer perpetrated by private citizens. Pity. Those we get nowadays lack *espièglerie;* they're no fun, nobody laughs. They're not even *supposed* to be funny.

Everyone drives a car in this day and age, so why not just drive to New York City? Well, there are precautions to take here, also. For one thing, as you will discover for yourself, there are too many cars in Manhattan. The city administration mounted policies which actively discourage people from driving into the city. It is not legal to keep you out, but they can make you sorry you came.

The first thing they did was to make the tolls on bridges and tunnels one-way. For example the Holland Tunnel, Lincoln

Tunnel, George Washington Bridge and Tappan Zee Bridge — all cost a dollar eastbound, and are free westbound. This is to encourage emigration. Some inequities exist in any plan, of course: A Jerseyite drives to work in Manhattan and dies there, he's out fifty cents.

Parking in the city is not merely tricky, it's a near impossibility. If you do see a parking space, stay out of it. It's a trap. If it weren't, some native would be already in it. "NO PARKING" signs are usually on poles, but sometimes you park in a cleared space and come back to find that *portable* no parking signs have been set up by your car, and you are in retroactive violation.

My wife drove down to the city to see a specialist near 75th Street. We parked at what looked like a reasonable place. The signs seemed to say that we could park for two hours. There was a Tow-Away Zone sign well down the block, but so placed that it didn't seem to apply where we were. We fed the parking meter a good breakfast of dimes and left. We came back a few minutes late. No car. I found out where the car pound was (on a dock; they tow away motorboats, too). It cost us $50 to get our car, and this is the going rate. I asked three times if $50 covered all charges and was thrice assured that it did. Months later I got a bill from the City for $30, of which $25 was for the violation, and $5 for a scofflaw charge. Included was a threat to take it out of my hide. Granted, we were over-parked, but $80? Probably, a summons had been placed on my car, stolen and hawked by the junior citizenry. The man I called about it told me this often happened. He thought it was funny.

If you park in a lot, they will demand your key "so we can move it if we need to." If and when they need to, they move it out in the street. It won't get tagged, but it may suffer a scraped fender. "Must 'a happened before you come in, Mack."

Parking garages are fine, but they close at 5:30 pm or some such, and your car is locked up for the night. They will admit this if you ask, but would never volunteer the information — you are supposed to know.

When I go, I take the bus all the way — and this is harassing, too — or I drive and park in the municipal lot at Fort Lee, New Jersey. Then cross the river on a bus, subway downtown. Saves $80 parking fees.

This last trip, my first stop was Canal Street. I talked to L. Cates, who started in the middle 40s. He has one of the best stocks in the city, including solid state. He told me that Leopold was no longer at Leeds, and that Mike Kranz had retired. Many of the old stores are gone. Leotone on Dey Street. For that matter, so is Dey Street. Cates' place is the first I'd visit on a subsequent trip. It is on Canal between Sixth Avenue (Avenue of the Americas in the modern mode) and West Broadway, north side of the street, number 383. Across the street on the corner at 380 is his old place, now called Richmond.

The store is a little different, the stock is different, but with many good items. The walls are lined with test equipment — few oscilloscopes, and these mostly early Tektronics, the small ones. The bulk is special stuff of all kinds. I noticed a bolometer, whether with bridge element or not I don't know. But this is an indication of what you can find.

In the next block, three plastics houses, one metals house (rod tube, sheet, aluminum, stainless, grill) and three or four radio houses. One good.

Then on to Chinatown for lunch. At the corner of Mulberry and Canal, something new: A small movie house for Chinese, showing Japanese X-rated films. It had to be small, being in an office/apartment building. Chinese, because the show-cards were titled in ideographs, without any Roman letters at all. Why Japanese? Good question. The Japanese consider luxuriant eyebrows to be a beauty mark, and the pictured characters had them. Shaggy ones. This ends the question period.

Up to Mott Street and following it nearly to its far end, to a Chinese restaurant, downstairs. I remembered it from 20 years ago. Egg Foo Yong. Yat Gar Mein ("Yah-ka-minn") kumquats. The tea is genuine Chinese tea now, from Tai Wan, far more tasty than the dark stuff of only a year ago.

Now downtown to Warren Street. Leeds (at 57 Warren) under new ownership, looks

much the same, except for a less lavish window display. Metro, on the other corner is supposed to be all hi-fi now. Isn't. A studio has been added, but the place is the same as it always has been, even to the Grebe receiver in the window. He has a different kind of customer, less sophisticated than Cates', but still inclined to do his own electronics. They want information, and more than that, reassurance, and they get it. I can remember when I thought speakers and transformers had to be matched *to thee Ohm,* and sympathized. I had to talk to Denby, the proprietor, between customers, of course, and these came in a steady stream.

It came to me, then: Surplus merchants and customers understand each other. Denby didn't waste any time, but he gave each customer his full attention. The traffic flow was steady, and fairly rapid. With Cates on Canal Street, a customer would duck in, ask for something, get and pay for it, and then duck out. The rate seemed to be about four in ten minutes – I should have timed it. They knew exactly what they wanted, and he knew what he had. It takes that kind of merchandising with small-profit items and New York rents. Lots of other merchants could learn from men like these.

Blan, next door at 52 Warren, has a lot of special industrial stuff, *not* surplus. Lafayette at 45 Warren, is blister-packed. G & G has moved upstairs over Lafayette, no longer at Leonard Street. The proprietor is a very old gentleman who could have retired many years ago but chose to continue merchandizing. His sign at the door is a sign of the times: "Door locked. Call 267-4605 for entry. Retail sales Saturday only, 9:30 am to 4:30 pm." He always had a good catalog, and specialized in military/radio surplus and aircraft instruments.

Cortlandt Radio also has a good catalog, and was also locked up, though it was only about 4:45 pm. This parts house is at 1144 West Broadway, near Chambers. Arrow, at Chambers and Church, a couple of blocks east, is an old parts house with a ham department. They had crystals for any frequency in the old days. You can still get miniboxes there. I even saw the long ones, that you put the strip-lines in for UHF converters and such. But all of these merchants like the large unit sales and this means TV and hi-fi. That's where the money is.

Back on Warren Street – Radio Row, Inc. holds no interest for hams, because it is a TV outlet. Pity, with a name like that. On Church Street (number 178) between Reade and Duane Streets dwells Adson. They too have miniboxes, and a lot of books and parts.

Harrison has moved out of town, so there is no big ham-only store.

Uptown: Another Lafayette at 55 45th Street. It was closed, but all I saw was TV and hi-fi. But a few doors to the east, at 35 West 45th, is Heathkit. It was closed when I got there, but appears to be agency/advisory/test center, with an extensive window display. Leonard Radio is now uptown at 1165 Broadway, north of 45th. Radio Shack is on West 45th, next to the Hotel Normandie, opposite the Topless Go Go Bar, west of 6th Avenue.

Oh yes, Barry is still at 512 Broadway, just north of Canal, between Broome and Spring. You can spot his yellow sign, with just the name in vertical letters.

Last, but not least, the FCC office where ham exams are given has moved from the old brick Post Office building on Christopher Street, about ten blocks south to 201 Varick Street. Varick is the continuation of 7th Avenue, starting at Houston, which is a divided parkway as of recent years. Take the West Side IRT subway to Houston and you will be very close.

It is a pity that so many street signs are missing, and so many house numbers over doors, but that's New York. Got to keep the cars out some way. Oh, I forgot: The ham exams are Wednesdays only and require a Post Office money order for $4 made out to the FCC, or you don't get to take it.

Now that you know where some of these places are, and you don't have to hunt for them, you can at least manage a Chinese lunch in addition to shopping. (In Chinatown everyone drinks coffee, the place is full of coffee shops.)

If you can, get the Exxon map of New York City and Long Island. It is excellent. And if you watch, you will see some odd

sights in the city. I saw a Rolls Royce turning into Reade Street and did a double take. A Rolls is not a large car, about Buick-sized, but Reade is a small street. Then I saw that the classic Rolls front end had been mated to a VW, or the bug behinder grafted on to a Rolls front end – anyway, the mutant made the turn as if hinged in the middle. Beautiful workmanship, no seams, a body-shop job, likely, but there was no advertising sign on it. Possibly somebody's comment on body styling or prestige cars.

On Canal I saw a Pontiac sedan double-parked, way out in the street, in *that* traffic! A police officer was writing out a $25 ticket, and a woman was leaning out the right front window and milking the horn, the cop threatening her the while. It looked as if Pop told her "I'll only be a minute" and went into a store, taking the keys with him. He was probably hiding there. First time in years I saw a big car get a ticket. Maybe they should leave the island where it is.

. . . BACH

Bill Pasternak WA6ITF
c/o 73 Magazine
Peterborough NH 03458

Looking Back - Looking Ahead

In October of 1960, a man's dream became a reality. The man was Wayne Green W2NSD and his dream was to publish an amateur radio magazine that would truly serve the needs and interests of all amateurs. Wayne must have done something right, because today, some fifteen years later, 73 is still around and still growing. There have been many changes since Volume 1 – Issue 1 and what you are reading today is the culmination of many years of hard work, yet ever changing to keep up with your needs.

I was 18 years old and living back in Brooklyn where it all started at the time. 1379 East 15 Street, Brooklyn, New York, was the original "office" for 73, if it could be called an office. Actually, it was a rented apartment on the second story of a two story house in what is known as the Flatbush area of Brooklyn and served the multiple purpose of editorial office, drafting room, and layout area as well as a home for the editor himself. The staff: basically 99% Wayne and Virginia.

I learned about 73 just before Issue 1 went on the newsstands through two friends that would both figure in the early success of the magazine. One afternoon in mid-September of '60 I was "bumming" around with Larry Levy WA2INM and we happened to run into John Peterson WA2FMF. At that time John lived on East 8 Street and after a couple Cokes at John's house it was suggested that we walk over to pay Wayne a visit and see how his project of a new amateur radio magazine was getting on. It was on that day that I too became hooked on writing about our wonderful hobby due to the mystique of that man himself, Wayne Green. Looking back over the years, I can see that I was not the only member of our "trio" that got hooked into the amateur publication field. Within months of the first issue, Larry had become a regular contributor to 73 and most of his articles were far ahead of their time. In fact, Larry discovered the transistor and the many uses it could be put to about 10 years ahead of the ARRL, and whenever something new came out of the INM basement workshop on East 18 Street, it was shared with the world in short order through 73. John became a

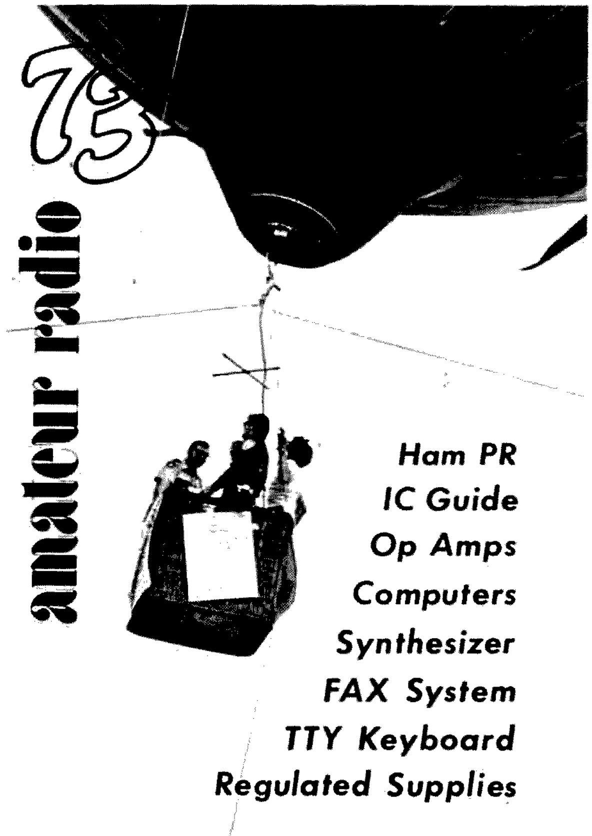
staff assistant in '61 and remained with 73 till he entered the Air Force. Of our trio, Larry is the only one left back in New York. A few years ago, John and I became native Californians. Actually, it was talking with Larry this morning via Ma Bell that brought on this article.

On page 25 of Issue 1 is where the guidelines for the future of 73 were set. In looking back over the past 15 years, I think the magazine has tried to live up to what was said there.

Policy #1: We are not mad at anybody. We weren't, but unfortunately others were mad, or perhaps jealous of 73. Till that time there had been little competition within the field of amateur radio magazine publishing. In fact it had been for many a year a two magazine market with one echoing the ideas of the other. All of a sudden new competition with new forward looking ideas. Not only was 73 breaking down all the old "dogma" that had been fed to hams for many a year, but giving the others a run for the money in doing it. Of course the competition would get mad and try to retaliate; in business you are a fool if you don't. But the fact that 73 is still here today must say something. That fact that 73 continues to grow must even say more.

Policy #2: Amateur Radio, in its dual role as a means of arousing the interest of youngsters and providing the basic training for entry into the field of electronics, one of the largest and most promising fields we can see ahead, and as one of the most important means of communications between the peoples of the world on a people to people basis instead of through the press or government channels, is probably the most important hobby in the world today. We can keep it important by being aware of what is going on in our hobby and being technically up to date. 73 Magazine is dedicated to focus the frontiers of amateur radio. I will strive to broaden the technical interest of the amateurs and encourage them to higher technical attainments and abilities by means of technical and construction articles written by the best talent available. Through the years and down to the present the foregoing has held true. No one can deny that 73 has always been a bit ahead of the others in bringing to amateurs the most innovative technological advances, and doing so on a level that the average ham could comprehend. You don't have to be an engineer or physicist to read and understand what comes in 73. It's written for the average amateur, not the intellectual minority.

Broaden interest and encourage higher levels of technical interest? That began with Issue 1. A glance at the table of contents revealed everything from a tubeless electronic key to a tech article on how to FM your transmitter with a newly discovered device known as a Varicap Diode. This was well before the days of packaged import radios and mountaintop repeaters! Today's biggest trend being written about way back then, wow! Down through the years 73 has tried to keep a little ahead of the rest and has made a couple of boo-boos. But, 73's staff has never been too big or complacent to admit they made a mistake and publish corrected information. Maybe that's part of the reason 73 is still around; it grew but never forgot what it set out to do. The staff may make mistakes in the future; no one is



perfect but at least 73 is willing to face the challenge of the future with a keen eye and open mind. The precept as set down in policy #2 holds as true today as it did in 1960 and perhaps even more so. To that ideal this magazine is and always has been dedicated.

Policy #3: Few talented writers have continued to buck the present system whereby they receive either nothing for their efforts or else have to wait from one to three years for minimal pay. 73 has established the policy of paying for all accepted articles with immediate cash. This seems to be bringing new life to the field for we are receiving top notch articles from some of the best authors in the hobby. In the years that I have been associated with 73 the above has held true without exception. It's simply the principle of getting what you pay for. If you are going to stimulate an author to write, then pay on the line if you want it. But it was more than that. Out of the ranks of contributors came some of today's best known and respected writers because 73 was not scared to print the work of a then unknown. It was equal treatment to all regardless of writing background that was paramount. Articles were judged on their technological merit and the kind of interest they would provide the reader. Some authors have gone on to careers in the field while to others it was a one-shot deal and they were never heard from again. In all cases it has been up to the author to decide if he wanted to continue on his writing, but the pages of 73 have always been open to all. It has been you, "Joe Amateur," that has guided the destiny of 73 all these years; the staff has only given what you asked of it. I personally have never had to request payment for an article published in 73; the check has always arrived well before the publication date. To 73, a promise made in print is a promise.

Policy #4: It is our intention, the SEC permitting, to open the ownership of Amateur Radio Publishing Inc., to interested amateurs so that the ownership of the magazine can be widespread and the magazine will be truly owned and run by licensed hams. This is one part of the dream that has yet to come to fruition, but who are we to know what the future might hold? Someday, this part of the dream that is 73 might well come to pass. Who are we to say?

Policy #5: We intend to encourage and promote the publication of bulletins to bring specialized operating news of the many facets of amateur radio: VHF, RTTY, DX, Traffic Handling, TV, etc. No one can deny that over the years we have lived up to this one. There have been countless specialized publications as an outgrowth of 73 over the years: books on ATV, VHF, repeaters, coax cable; the list is almost endless and continues to grow. Well before repeaters were the big "in thing," 73 was publishing its Repeater Bulletin as an aid to the owners and users in the Northeast. Believe me, as one of the contributors to Repeater Bulletin, it was strictly a labor of love that served the purpose of its time and finally outlived its utility. But it was there when the need was there and because the need was there. Financially it was an economic disaster. There were but two organizations that could have handled such a project, the League or

73. Since the League showed no interest in that direction, 73 took on the task since someone had to do it. When its job was done it went away, but the job had been done and that's what really counts.

Well, there you have it. A brief synopsis of the past 15 years and a review of the accomplishments that have gone before us. If I seem a bit proud to be associated with this magazine, you are absolutely right. We have proven the self-professed experts wrong, survived and prospered, thanks to you. We never forget that a magazine is only as good as its readership and being associated with amateur radio operators like you is one of the most stimulating experiences one can imagine. The new ideas, new concepts and new frontiers are but limited by your own imagination, and when that imagination takes root, blossoms into a reality, the first notice of it usually is to be found in the pages of 73. Maybe we have not been able to keep each and every promise verbatim, but we are still trying. We are not afraid to try!

. . . WA6ITF

Caveat Emptor?

PRICE — $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

HW-7 KIT. Overpurchase. Absolutely new in original box. Sent postpaid for first $60. Schultz, Box L, FPO New York 09544.

FOR SALE: Icom 230 complete with all splinter crystals, with gorgeous red touch-tone phone. Manual. 73 staffer's pride and joy. $355. UPS — prepaid — cashier's check only. Bill Edwards WB6BED/1, c/o 73 Magazine.

PC BOARD negatives made photographically from your artwork. Now obtain professional results quickly, simply. 4x5 $3.00 or SASE for information. Hatfield WA4FRV, 10139 Apache Road, Richmond VA 23235. 804-272-8403.

LOOKING FOR JAN 1961 issue 73 Magazine. Please write, stating price, only mint condition. All letters answered. R. H. Wilson, 4011 Clearview Drive, Cedar Falls IA 50613.

FREE: 8 Extra Crystals of your choice with the purchase of a new ICOM IC-22A at $249. With the 10 crystals that come factory-installed in the IC-22A, this gives you a total of 18 crystals! For equally good deals on Drake, Collins, Kenwood, Ten-Tec, Regency, Swan, Atlas, Midland, Alpha, CDE, Standard, Tempo, Genave, Hy-Gain, Antenna Specialists, CushCraft, Mosley, Hustler, and others, write or call Hoosier Electronics, your ham headquarters in the heart of the Midwest and become one of our many happy and satisfied customers. HOOSIER ELECTRONICS, P.O. Box 2001, Terre Haute IN 47802. NOTE OUR NEW PHONE NUMBER: (812) 238-1456.

QSL CARDS — Something completely different. Nothing even close to it on the market! Samples: 25¢ stamps or coin. W5UTT, Box 1171F, Garland TX 75040.

CALL LETTER LICENSE PLATES — still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate — most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

FOR SALE: Drake TR22C 2 meter FM transceiver with mike crystals, 10 new Nicad batteries, Drake ac 10 power supply, AA10 amplifier vinyl carrying case, manuals. Above purchased new in 1975. $224. Postpaid or acceptable offer. George Konnick, Apt P2, 1750 West Main Street, Riverhead, N.Y. 11901.

HP-65 USERS exchange ideas, programs, methods. Monthly newsletter. Request information and sample newsletter. Richard Nelson, 2541 W. Camden Pl, Santa Ana CA 92704.

SURPLUS RECEIVERS, components, test equipment. Catalog free. Ed French, P.O. Box 249, Aurora IL 60507.

HT220's, 2 meters and 450 and PT300 on 6 for sale. Like new and guaranteed so not inexpensive. (804-272-8403) Want late aircraft radio equipment.

WESTERN Electric 3A Speakerphone complete $125.00. TT Card Dialer with cards $100.00. Bob Crotinger, 687 French Road, Rochester NY 14618. (716) 244-6296 after 7 pm.

WANTED – DRAKE TC 2 transmitting converter, any condition. Will pay shipping. Also need INTEL 8080 IC, non working Argonaut. WB0GAZ, 457 Farrand CU, Boulder CO 80302.

BLIND HAM, just passed General exam, would really appreciate used 160m to 10m transceivers donated. Please send to: WA0YQO, 137 N. Lawn-Apt. 10, Kansas City MO 64123.

FREE BARGAIN CATALOG. LEDs, ICs, microphones, headsets, resistors, relays, ultrasonic devices, precision trimmer capacitors, unique components. Low, low prices! Chaney's, Box 15431, Lakewood CO 80215.

PHOTO-STAMPS. Great for QSL cards. Sheet of 100 stamps. Gummed and perforated. Send any photo and $3.95 to: Unique Photo, Box 496, Hudson MA 01749.

KWM-1 KWM-2/2A S/Line Booklet on Problems and Solutions is completed. Price $2.50 to cover printing, material and postage. Frank Andrei W3OEL, MR 1, Saltsburg PA 15681.

VERY INTERESTING! Next 4 issues $1. "The Ham Trader," Sycamore IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering receivers, transmitters, transceivers, amplifiers 1945-75. Indispensable!)

RADIO ARCHIVES, amateur ANECDOTES (then & now) solicited for proposed (SASE subscription) monthly PR newsletter. Electronic Avocations, 3207 fourth St. N., Mpls., Mn. 55412.

FM RECEIVER, preamp, scanner, UHF converter kits. Hamtronics, Inc., 182 Belmont, Rochester NY 14612.

POLICE AND FIRE Scanner Special – Regency ACT – R – 10 H/L/U 10 channel 3 bands, combined ac/dc 10 free crystals included $169.00 prepaid, dealer inquiries invited, Four Wheeler Communications 10-F New Scotland Avenue, Albany NY 12208.

TECH MANUALS – $6.50 each: R-220/URR, SG-3/U, URM-25D, USM-159, TT-63A/FGC. Thousands more available. Send 50¢ (coin) for large list. W3IHD, 7218 Roanne Drive, Washington DC 20021.

COLLINS: 30S-1 2kW amplifier, excellent operating and physical condition, trade for Bendix R-1051B/E receiver same condition. Sid Sidman, Star Rt #1, Box 88, Oakhurst CA 93644.

FOREIGN LANGUAGE cassettes. 2 – 60 minute quality tapes per set. French, German, Italian, Spanish. $6 a set, 4 sets $20. Royal, Box 2174, Sandusky, Ohio 44870.

WANTED: Tower, heavy duty, motorized crank-up, 80 foot or more. Also want 30-S1 or Alpha Linear. W0PDI, Route 2 Box 218, Buffalo MO 65622.

MICRO-TO MK II deluxe epoxy-glass drilled circuit boards. $4.00 postpaid; with semicons $11.80. K3CUW, 1304C Mass. Ave. S.E., Washington DC 20003.

WANTED: Mobile telephone equipment such as Delco, GE, etc. Also heads, decoders, duplexers. Greg Hyman, WA2OTG, 19 Sicard Ave., New Rochelle, New York 10804, (914) 636-2494.

James P. McAdams WA5OKA
2604 Oaks
Pasadena TX 77502

Updating the Heathkit IB-1101

For people like myself, who want a frequency counter for a tool instead of a construction project, a good way to go is to buy a kit. In particular, I have found the Heathkit IB-1101 to be a very good counter for the price. The time base is quite stable (mine drifts from 1.2 Hz high to 0.6 Hz high during warm-up) and it will count to somewhat in excess of 100 MHz.

However, it has a problem. The only counting periods available are 1 millisecond and 1 second. This makes the use of the counter annoying in the "kHz" position because it only updates its display with a new count every 2 seconds. Also there is no way to make an accurate count on frequencies below 100 Hz. A 10 second count is needed for this.

With these facts in mind, I added circuitry and switching to make each decade from 10 seconds to 1 millisecond available from the time base. I also provided for external gating and reset. This freed the counter for a wide variety of counting and timing uses.

At this point, I might mention that I have never used the external inputs. If you are not interested in the external gating and reset functions, and you do not need accuracy at the low audio frequencies, you can get away with no added integrated circuits, only switching.

Circuit Description

To accomplish the desired functions, switching must be provided for the decimal point, the range indicator, the gate, and the reset. As in the original circuit, no switching is required for the input to the memory latch. Of these functions, the generation of

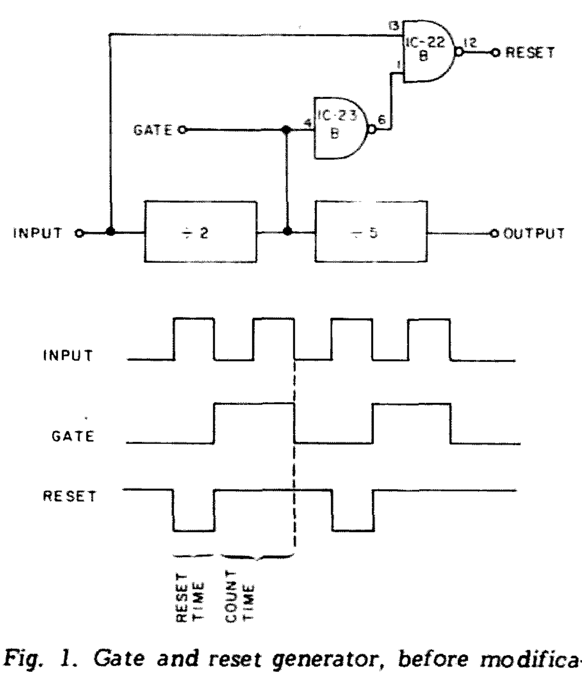


Fig. 1. Gate and reset generator, before modification.

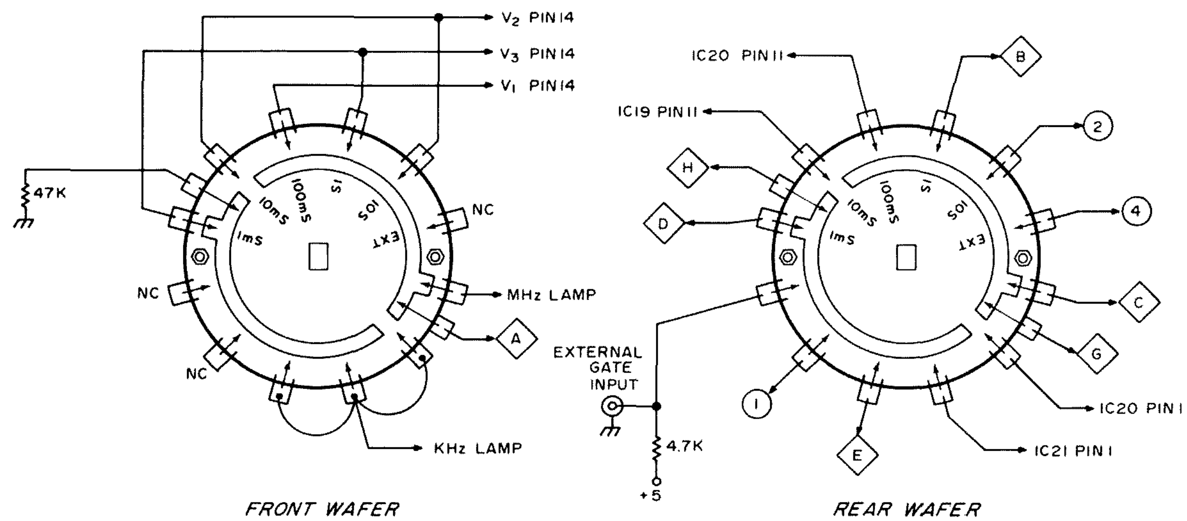
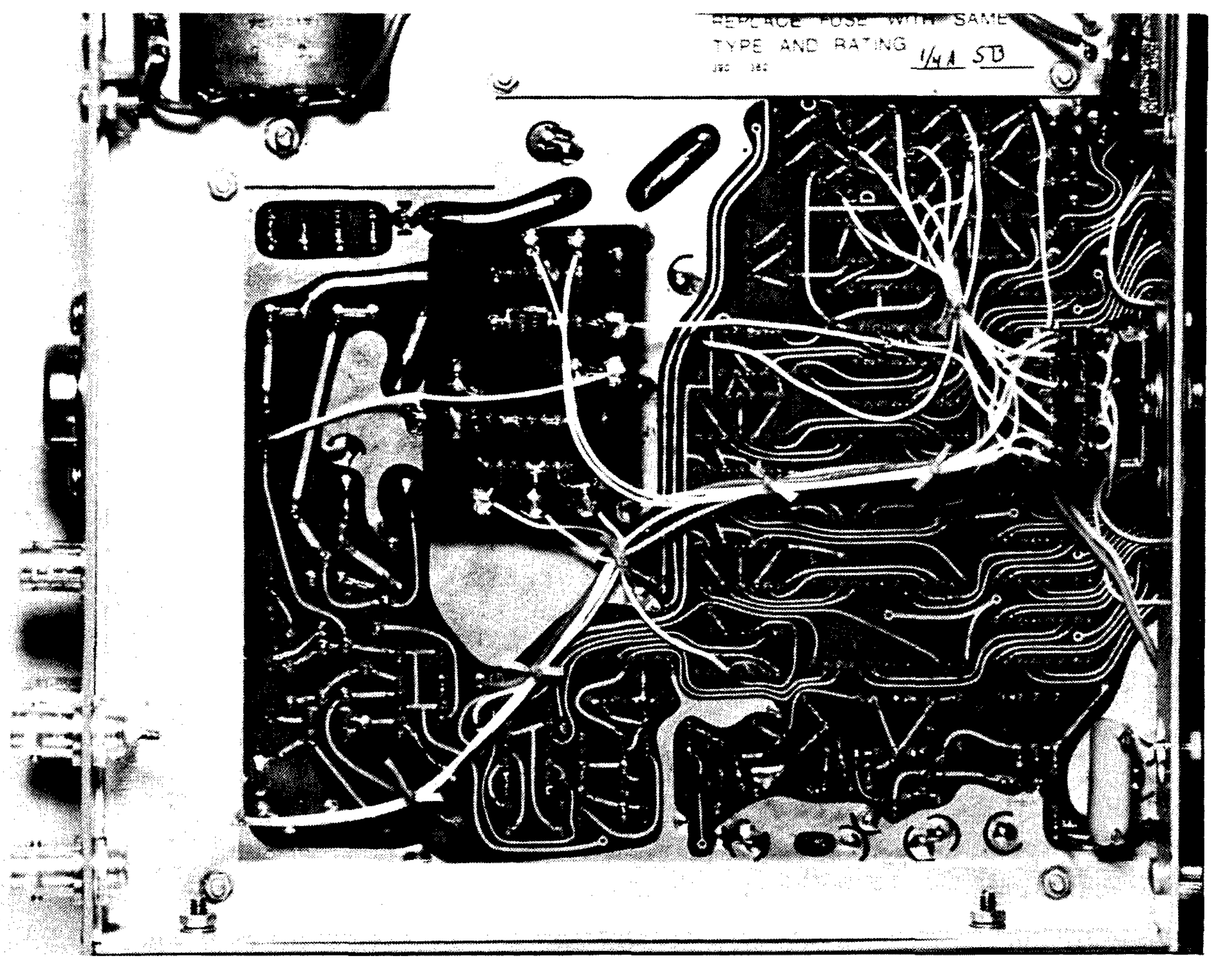


Fig. 2. 4-pole, 6-position rotary switch connections. Numbers in circles refer to Fig. 3. Letters in diamonds are Heathkit designations printed on PC board. Switch wafers are shown from the rear in the MHz (1 ms) position.

the gate and reset signals might be of interest to home brewers who do not own an IB-1101, so I will explain it here.

Following the time base oscillator is a string of 7490 decade counters. Each 7490 consists of a divide by 2 and a divide by 5 circuit. For this application, the binary stage is used as the input. As shown in Fig. 1, the gate signal is simply the output of the binary stage. This line connects to the J and K



Underside view of the counter, showing the added printed circuit board and rotary switch.

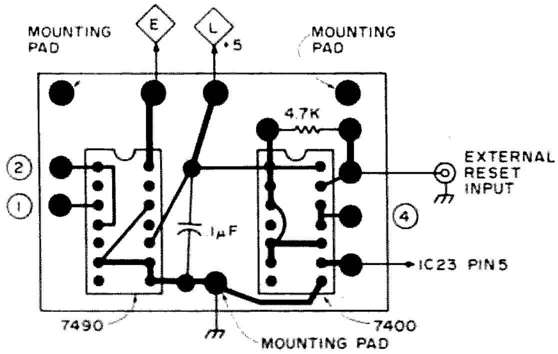


Fig. 3. Printed circuit board for the added functions, foil side view.

inputs of the first flip flop in the counter (a JK flip flop, of course); thus, the gate is open when the gate signal is high. Using this scheme, T=1/F, where T is the time that the gate is open, and F is the frequency of the square wave input to the binary stage. To get a 1 millisecond count, therefore, apply a 1 kHz wave to the input.

Reset is in effect when the reset line is low. The integrated circuits used in the counter will not count when the reset is activated. By the way, to reset a 7490, this reset signal must be inverted because a 7490 resets with a high input. The logic timing diagram in Fig. 1 shows how the reset occurs just before the gate pulse. The NAND gate requires that the gate line be low for a reset to occur.

Modification Details

A 4-pole, 6-position switch is necessary and it must be small, due to a lack of space in the IB-1101. These requirements are satisfied by the Centralab PSA-211. It is a 2-wafer rotary switch. The switch connections are shown in Fig. 2. This switch completely replaces S102, and, in order to mount it, you must make a pair of small plates to cover the square hole for S102. The plates are drilled for the PSA-211 and bolted to the chassis using the mounting holes for S102.

Two changes must be made in the printed circuit board. R21 must be removed. Also, the printed circuit bridge between pins 2 and 5 of IC-23 must be broken so connection can be made from the external reset circuitry to pin 5. Do not break this bridge if the external functions are not desired.

Due to the small size of the pads on the

Heathkit board, small wire and care in soldering should be used. I used #24 stranded wire with teflon insulation (Alpha Wire #2844/19). The teflon is very convenient because it will not scorch or shrink from the heat.

Fig. 3 shows the printed circuit board for the added decade and external inputs. It is installed by perching it on 3 pieces of stiff (#18) bare wire which are soldered to the mounting pads on the added board, and to the ground plane on the Heathkit board, as shown in the photo. One of these provides the ground connection for the extra board.

Take a look at Fig. 4. I did not notice this when I originally performed the modification, but if you connect pin 5 of IC-23 directly to the external reset input, one of the added gates (inverters) can be eliminated. The advantage of doing this is that IC-23 has an unused gate. So, by making the proper changes to the Heathkit circuit board, the extra 7400 can be eliminated. I leave this as a suggestion to you.

The only thing left is the functioning of the external inputs. When the external gate input is low, the gate is closed. When the external reset input is low, the counter resets, independently of the gate. With the connections as in Fig. 4, the count cannot be transferred to the memory and display until the gate is low. This means that you cannot see the tally until you close the gate. The addition of a switch, as shown in Fig. 5, will allow the count to update 5 times per second independently of the gate and reset conditions.

To do this, remove IC-23 and break the printed circuit bridge between pins 3 and 9. After reinserting IC-23, solder the 4.7 k 1/4

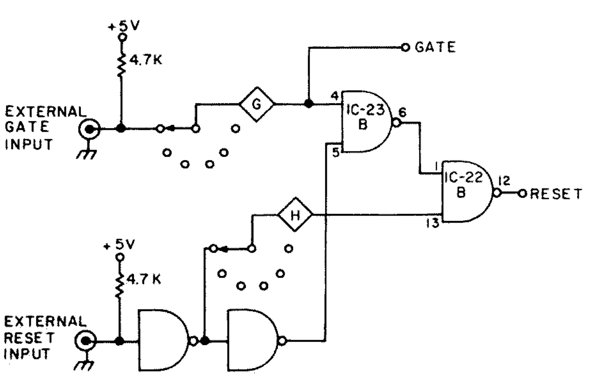


Fig. 4. Modified gate and reset generator with the function switch in the external position.

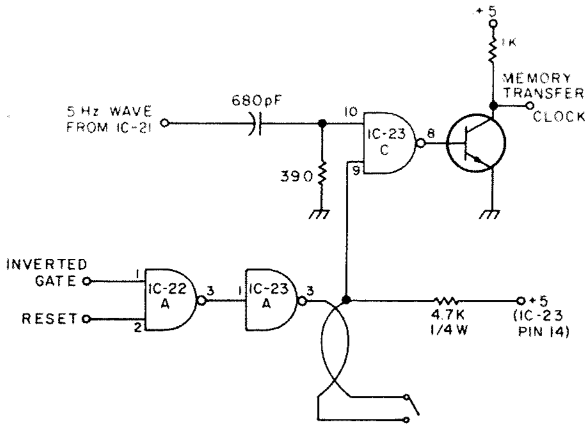


Fig. 5. Circuit to allow continuous transfer of the count to memory, independent of the gate or reset state.

W resistor between pins 9 and 14. The switch is then mounted on the back panel and connected between pins 3 and 9 with a twisted pair. When you close this switch, the counter will function normally. This modification is not in the photograph, but it is in my counter and it is quite satisfactory.

These modifications should add greatly to the use and enjoyment of your IB-1101 counter.

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HAM HELP

According to long-standing policy, *73 Magazine* makes a continual effort to match those in need of technical help or instruction with those who feel they can offer it. If you find yourself in one of these two categories, please do yourself and amateur radio a favor by contacting Ham Help, *73*, Peterborough NH 03458.

I would like to get on the air, but need a little help in code practice and general laws, plus a brush up on transistors. Have most of my technical background in tubes. Would sure appreciate someone's help, around the Santa Monica, Ca. area. You sure are a Godsend to people like us.

Louis W. Schwamberger
3139 Sawtelle Blvd.
W. Los Angeles CA 90066
Phone 398-3046

I have just finished reading one of your Ham Help columns. I have been trying to get in contact with someone, anyone, in San Antonio, Texas, to help me become a ham radio operator – the right way.

I have looked in the phone book, called several radio repair shops (and even the local radio and TV stations), but the only things they could come up with were "CB" clubs. I am sure there are hams and ham clubs in the area, but I have been unable to contact any of them – and even then I don't know if they would help me.

I know quite a lot about "CB" but almost nothing about ham operation. "CB" has turned into such a nightmare that it is no longer serving a useful function in this area. I would desperately like to become a "good" ham but I do need HELP.

Dale C. Babb
5763 Broken Lance
San Antonio TX 78242
(512) 623-3942

For the names of this month's Ham Helpers, please refer to our LETTERS section, beginning on page 6. – Ed.

STATEMENT OF OWNERSHIP, MANAGEMENT and CIRCULATION (Act of August 12, 1970: Section 3685. Title 39. United States Code) 1. Title of publication 73 Magazine. 2. Date of filing 30 September, 1975. 3. Frequency of issue. Monthly. 4. Location of known office of publication (Street, city, county, state and ZIP code) (Not printers) Pine, Peterborough, Hillsboro, NH 03458. 5. Location of the headquarters or general business offices of the publishers (Not printers) Pine, Peterborough, Hillsboro, NH 03458. 6. Names and addresses of publisher, editor, and managing editor. Publisher (Name and address) Wayne Green, Peterborough NH 03458. Editor (Name and address) Wayne Green, Peterborough NH 03458. Managing Editor (Name and address) Jack Burnett, Peterborough NH 03458. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given.) Name 73 Inc, Peterborough NH 03458. Wayne Green, Peterborough NH 03458. Virginia Green, Peterborough NH 03458. 8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state) Name none. 9. For optional completion by publishers mailing at the regular rates (Section 132.121, Postal Service Manual) 39 U.S.C. 3626 provides in pertinent part: "No person who would have been entitled to mail matter under former section 4359 of this title shall mail such matter at the rates provided under this subsection unless he files annually with the Postal Service a written request for permission to mail matter at such rates." In accordance with the provisions of this statute, I hereby request permission to mail the publication named in Item 1 at the reduced postage rates presently authorized by 39 U.S.C. 3626. (Signature and title of editor, publisher, business manager, or owner) Wayne Green, Publisher. 11. Extent and nature of circulation. (X) Average No. copies each issue during preceding 12 months. (Y) Actual number of copies of single issue published nearest to filing date. A. Total No. copies printed (Net Press Run) (X) 91,846 (Y) 93,201. B. Paid circulation 1. Sales through dealers and carriers, street vendors and counter sales. 2. Mail subscriptions. (X) 88,621, (Y) 90,002. C. Total paid circulation (X) 88,621 (Y) 90,002. D. Free distribution by mail, carrier or other means samples, complimentary, and other free copies (X) 303, (Y) 312 E. Total distribution (Sum of C and D) (X) 88,924, (Y) 90,314. F. Copies not distributed 1. Office use, left-over, unaccounted, spoiled after printing (X) 2,922, (Y) 2,887. G. Total (Sum of E & F – should equal net press run shown in A) (X) 91,846, (Y) 93,201. I certify that the statements made by me above are correct and complete. Signature of editor, publisher, business manager, or owner. Wayne Green.

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from page 19

typewriter and the rapid pace of new IC designs for this application means the umbilical cord has been cut to our dependence upon antique Teletype equipment. This means that in short order we could experience a growth in RTTY such as we haven't seen before. We do need a lot of good design work now and articles to provide communications between designers ... we need some more modern rules and regulations from the FCC to unfetter our growth in this area.

Right now, where would you go in the ham bands if you wanted to run RTTY and SSTV on one frequency? You'd have to head for the VHFs and you'd lose the basic benefits of the whole deal. The fact is that RTTY and SSTV are growing together ... the television typewriter did it. If you've ever watched one of these tediously unfolding on SSTV you already know why we need to be able to shift to RTTY for typing.

Both RTTY and SSTV are ideal for storage on audio cassettes ... both are frequency shift systems. We will shortly have dynamic storage devices which will permit us to use the same television screen to display both RTTY and SSTV, so we will be needing common frequencies on the ham bands for this. How about some petitions to the FCC? And don't forget to stress ASCII for the RTTY, okay?

In the meanwhile, I'll bet that some of the more adventurous will be able to get STAs (special temporary authority) from the FCC for development work. And don't forget *73* when you write the articles.

PREVENTATIVE LICENSING

Since the expected new rules do not bode well for the Tech license, most Techs have been giving serious thought to getting a General before the fan gets hit. In view of what has been threatened in the rule proposals, this is the only prudent response.

Since most Techs have, in essence, already passed their technical exam, the main problem is that old Morse code ogre. The fact is that this is highly overrated as an obstacle – not because it hasn't been difficult to master, but because most operators have been using just about the worst possible way of learning the code, making it ten times as difficult and tedious as it needs to be. Unfortunately, virtually every code course available today perpetuates this ridiculous remnant of the 1930s.

If you stop and think for a moment (and who has time to do this, right?), ask yourself whether you might have a better chance of learning the code if you learned it once and for all at the speed you need rather than having to learn it over and over at different speeds. And that is what it comes down to ... the usual method is to learn the code at maybe one word per minute with very long characters ... then step that up to 3 wpm ... then 5 wpm ... then 7, 8, 9, 10 ... etc. In essence, the brain is being asked to set up recognition patterns for each of the 40 characters we are supposed to know at many different speeds. We could avoid all that total waste of time and effort by learning the patterns of code sound once and once only ... at 13 wpm.

This is the secret of the *73* cassette code course ... even the 6 wpm cassette has each character sent at 13 wpm speed, so you learn the sound of each character just once instead of over and over at different speeds. These cassettes are available directly from *73* or from many of the better ham dealers. The series consists of four cassettes, including one for rank beginners, which teaches the 40 characters, and one for 6 wpm (very handy for passing the FCC given 5 wpm tests when you are called up for a recheck, and you sure don't want to goof it). The 13+ cassette will overprepare you for the FCC's 13 per test. The 20+ cassette is a terror and it will make sure you breeze through the Extra test. We also have a 10 wpm for Canadians and a 25 wpm cassette for fanatics.

TELETYPE PARTS

A note from W8KAJ enclosed an announcement from Teletype Corporation to the effect that they are discontinuing the stocking of parts for the models 14, 15, 19 and 20 machines as of December first this year. Pity.

While the more modern machines do have considerable prestige, the old models have much to recommend them. The models 15 and 19 were designed to run 24 hours a day in newsrooms and they go for years with few repairs being needed. Machines such as the Model 33, so popular today, are designed for intermittent use, such as on TWX circuits, and they don't do well with constant use.

Amateurs interested in RTTY and computer folk needing an inexpensive I/O typewriter can do a lot worse than get an old model 15. They run between $35 and $100 these days most places. They are 60 wpm geared, so they are slower than newer machines – but then most applications don't call for speed anyway.

POSTAL MODERNIZATION

For years the post office has been using a simple 6" envelope (business reply size) to let us know that a subscriber had moved without notifying us. They would tear the label off the magazine wrapper, indicate the new address, send it to us and throw out the magazine and the rest of the wrapper.

Now some of the post offices are automated and a new form has replaced the rubber stamp on the wrapper address. This is a 10" wide, 22" long computer printout sheet mailed in a 10½" x 11½" brown envelope! The computer printout may be a lot more efficient, but they sure use a whole lot more paper ... new envelope is ten times as large. Not only is it immense, it is also completely unstandard in size – so it has to be handled by hand.

JORDAN IN THERE HELPING

Amateur radio does have friends in high places. A resolution proposed by New Zealand and seconded by Jordan was unanimously accepted by the recent World Scout Organization in Copenhagen to the effect that radio amateurs would be supported in their effort to retain the present frequency allocations. There were delegates from 86 countries, representing 14 million scouts.

SAROC HAWAII

A letter in the PHD News of Northwest Missouri brought a report on SAROC Hawaii. KH6BW wrote ... "I finally found out what SAROC means. It is Sahara Amateur Radio Operators Convention, originated at the Sahara Hotel in Las Vegas, and is a sort of professional convention, money making affair. The attendance was not what was expected – not many exhibitors were on hand and a lot of the technical talks were trite. According to the gal at the table, only about 250 persons were at the convention."

... W2NSD/1

LETTERS

from page 29

However, since most hams are expected to be honest, perhaps you could see that Mr. Biddle gets this info.

Basically, the device is nothing more than a balanced modulator with an audio frequency local oscillator. The oscillator was lifted from an article in *73* on a sine wave oscillator. Other oscillators will work, but from my experience, it must be a sine wave. Frequency should cover from about 2200 Hertz to 3500 Hertz. The transformers were junk box and no effort was made to optimize their inductance. The balanced modulator should see about 500 to 600 Ohms, so line to voice coil transformers should work. There is some loss (15 to 20 dB through the bal mod), so it would be useful to have a small audio amp on the output of the demod. The transformer on the output of the audio osc. can be chosen to match the output of the osc. and the input to the bal mod. The purpose here is to maintain a balance on the rig modulator (demod). Juggle levels into the device, audio levels, etc. I tape the ENcoded audio and play it back through my DEcoder. This permits adjustment of audio frequency and audio levels. The 20k and 400 Ohm trimmer resistors, once set, do not require frequent adjustment. Again, if you really want a decoder, and you are adept at figuring out small problems, then this should be enough to get one going. Mine works better than the PD unit. They have trouble with frequency drift and low audio, both of which can be corrected in my unit.

Charles R. Helmick W8JZN
Parkersburg WV

GREAT GLADE

I attended the Glade Valley Amateur Radio Session this year – and it is really super. I think that, after 16 years, Carl Peters K4DNJ should be commended for his outstanding job. I intend to go back next summer and work on Extra class.

Rev. G. Wayne Heck WB9HJM
Fort Wayne IN

ANOTHER YEAR

Enclosed please find a check for $8.00 for another great year of *73*. I have stopped my subscription to *QST* because I am tired of running through page after page of contest results, outdated projects, and ultra-complex articles aimed at the privileged few who are lucky enough to belong to the ARRL clique. Wouldn't you think that such an intelligent bunch of super engineers could design their own "Modular Counter" without stealing Mr. Stark's? Keep up your good work and well written articles for those of us who are not fortunate enough to have engineering degrees. Keep up the weather satellite articles by WB8DQT.

Paul J. Dujmich WR3TLD
McKeesport PA

SOCK IT TO HER

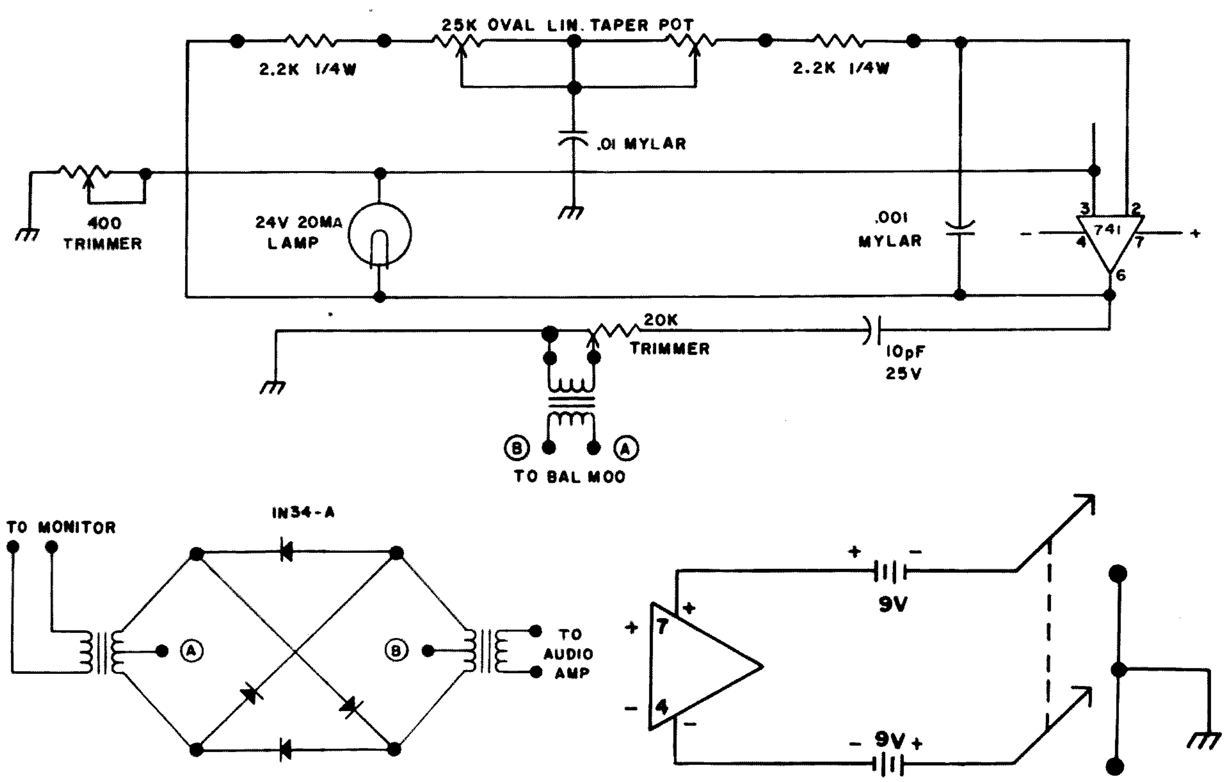
Your September 1975 cover made me think of a swell XYL-pleasing idea, which I would like to share with anybody who has a problem with a drawer full of stray, single, one of a kind socks.

Use one of these forgotten socks for a microphone cover. It works very well and keeps dust off a non-used microphone.

I said XYL-pleasing and so it is; just think how pleased she will be to see how clever and thrifty you are.

If you *really* want to please her, *change socks every day!*

Ray Sanders WA8VZO
Follansbee WV



The 10-0 Decoder.

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PROPAGATION CHART

J.H. Nelson

Good (open) Poor (0)

Fair (☐)

November – 1975

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	$\boxed{3}$	$\boxed{4}$	5	6	7	8
9	10	$\boxed{11}$	12	13	$\boxed{14}$	15
$\boxed{16}$	17	18	19	20	21	22
$\boxed{23}$/30	$\boxed{24}$	$\boxed{25}$	26	27	28	$\boxed{29}$

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	3	3	3	3	3A	7	14	14	14
ARGENTINA	7	7	7	7	7	7	14	14A	21	21	21	14A
AUSTRALIA	14	7B	7B	7B	7B	7B	7	14	14	14	14	14A
CANAL ZONE	7A	7	7	7	7	7	14	14A	21	21	14A	14
ENGLAND	7	7	7	3	3A	7	14	14A	14A	14	7B	7
HAWAII	14	7B	7	7	7	7	7	3A	7B	14A	14A	14
INDIA	7	7	7B	7B	7B	7B	7B	14	7B	7B	7	7
JAPAN	7A	7B	7B	3B	3	3	3	3	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14A	14A	14	14
PHILIPPINES	7A	7B	7B	7B	7B	7	7	7	7	7B	7B	7A
PUERTO RICO	7	7	7	7	7	3	14	14	14A	14	14	14
SOUTH AFRICA	7	7	7	7	7B	7A	14	21	21	14A	14	14
U. S. S. R.	7	7	3	3	7	7B	14	14	14	7B	7	7
WEST COAST	14	7A	7	7	7	7	7	14	14A	14A	14A	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	14	14	14
ARGENTINA	14	7	7	7	7	7	7	14	21	21	21	14A
AUSTRALIA	14A	14	7B	7B	7B	7B	7	7	14	14	14	14A
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	14A
ENGLAND	7	7	7	3	3A	7	7B	14	14	14	7B	7
HAWAII	14	14	7	7	7	7	7	3A	7A	14A	14A	14A
INDIA	7	7	7B	3B	7B	7B	3B	7A	7A	7B	7B	7B
JAPAN	14	7B	7B	3B	3	3	3	7	7	7	7B	14
MEXICO	14	7	7	7	7	3	3	7A	14	14	14	14
PHILIPPINES	14	7A	7B	3B	3B	7	3	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7A	14	14A	14A	14	14
SOUTH AFRICA	7A	7	7	7	7B	7B	7A	21	21	14A	14	14
U. S. S. R.	7	7	3	3	7	7	7B	14	14	7B	7B	7

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	3	3	3	3	3	7	14	14	14
ARGENTINA	14	14	7	7	7	7	7	14	21	21	21	14A
AUSTRALIA	14A	14A	14	7B	7B	7	7	7	14	14	14	14A
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	14A
ENGLAND	7	7	7	3	3A	3A	3B	7B	14	14	7B	7B
HAWAII	21	14	7A	7	7	7	7	7	7A	14A	21	21
INDIA	7	14	7B	3B	3B	7B	3B	3	7	7	7	7B
JAPAN	14A	14	7B	7	3	3	3A	3	7	7	7B	14
MEXICO	14	7A	7	7	7	7	7	7A	14A	14A	14	14
PHILIPPINES	14A	14	7B	7B	3B	7	7	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14A	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	7A	14A	14A	14	14
U. S. S. R.	7	7	3	3	3	3A	3	7A	7A	7B	7B	7B
EAST COAST	14	7A	7	7	7	7	7	14	14A	14A	14A	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.